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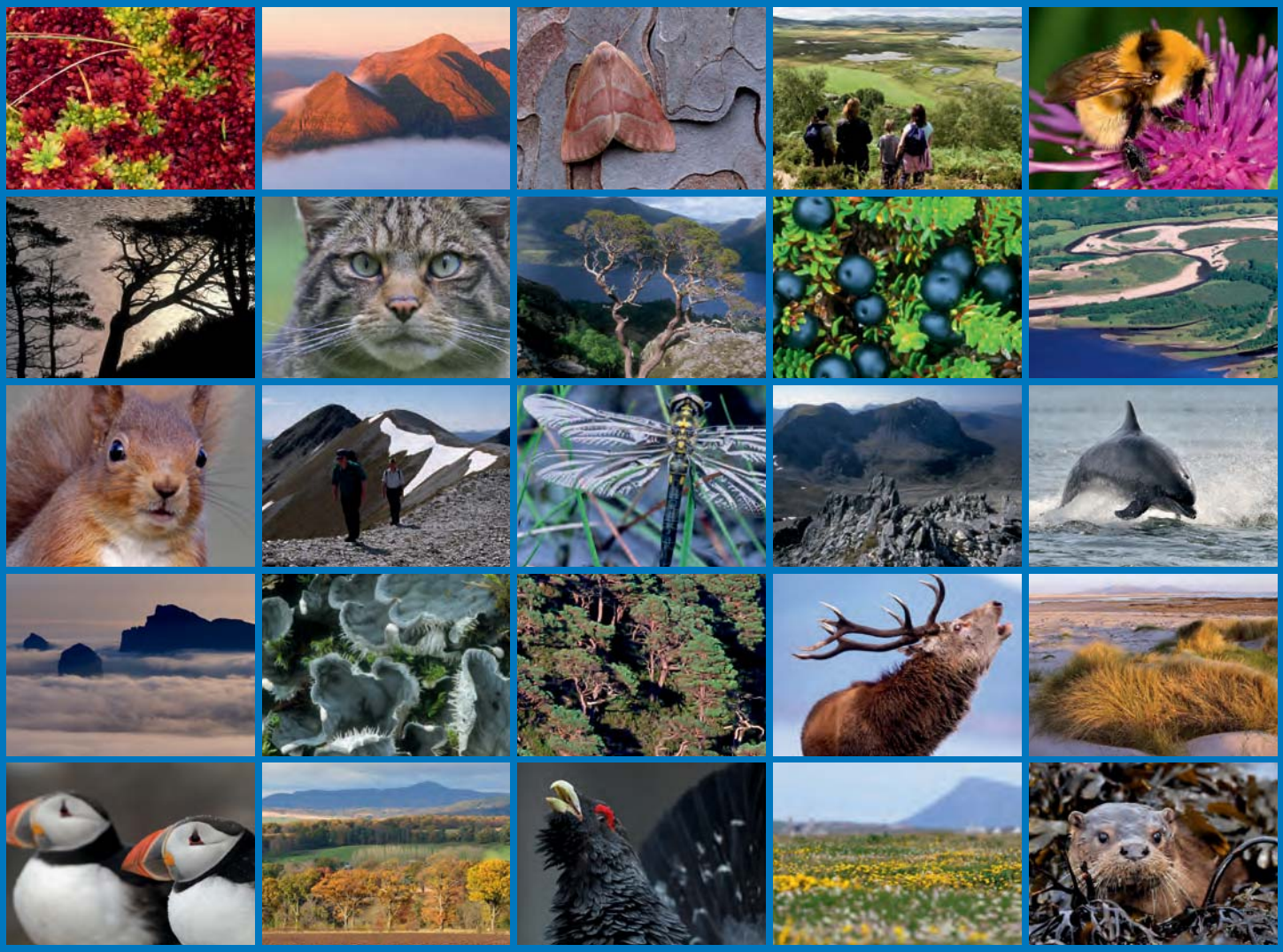
Scottish Natural Heritage
Commissioned Report No. 500

The distribution of selected MPA search features and Priority Marine Features off the NE coast of Scotland



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COMMISSIONED REPORT

Commissioned Report No. 500

The distribution of selected MPA search features and Priority Marine Features off the NE coast of Scotland

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COMMISSIONED REPORT

Summary

The distribution of selected MPA search features and Priority Marine Features off the NE coast of Scotland

Commissioned Report No.: 500
Contractor: Heriot-Watt University
Year of publication: 2012

Background

To help target nature conservation action SNH and JNCC have generated a focused list of habitats and species of importance in Scottish waters - the Priority Marine Features (PMFs). Provisions to designate new Marine Protected Areas (MPAs) within Scottish waters have recently been introduced through the Marine (Scotland) Act 2010 and the UK Marine and Coastal Access Act 2009. A subset of the PMFs (MPA search features) will drive the identification of Nature Conservation MPAs.

Two areas located on the north-east coast of Scotland were identified for survey due to records of MPA search features. The first of these areas is located just off Noss Head near Sinclair's Bay. The second is located within the outer area of the Moray Firth known as the Southern Trench.

The purpose of this study was to confirm the presence of a horse mussel bed, *Modiolus modiolus*, in the survey area off Noss Head and to determine if any other PMFs / MPA search features were also present. Sampling stations were also targeted in and around the shelf deep area of the Southern Trench to again identify the presence of any PMFs / MPA search features such as burrowed mud biotopes and ocean quahog (*Arctica islandica*) communities.

Main findings

- A total of 17 biotopes were recorded in 2011 within the Noss Head and Southern Trench survey areas using both drop down video and grab sample apparatus.

- The presence of a horse mussel bed (**SS.SBR.SMus.ModT**), a PMF / MPA search feature, was confirmed at 10 drop down video stations off Noss Head. Video analysis and previously collected acoustic multibeam data were used to estimate the full extent of the horse mussel bed. Using these data sources the size of the bed has been estimated to be 3.85 km^2: the largest known horse mussel bed in Scottish waters.

- Video analysis recorded 75 different taxa within the horse mussel bed, suggesting an extremely biologically diverse community. However, a full biodiversity assessment was not possible during our survey due to the inability of the sampling equipment to penetrate the horse mussel substrate to obtain infaunal samples.

- In addition to the biotope **SS.SBR.SMus.ModT** *e*ight other biotopes / biotope complexes were recorded at Noss Head including: **SS.SMx.CMx.OphMx**, **SS.SMx.CMx**, **SS.SCS.CCS**, **SS.SMx.CMx.FluHyd**, **CR.MCR.EcCr.FaAlCr, SS.SSa.CFiSa**, **CR.MCR.EcCr.FaAlCr.Bri** and **SS.SSa.CMuSa**. The most numerous and widespread biotope complex recorded was 'Circalittoral mixed sediments' (**SS.SMx.CMx**), which was observed at 39 stations.

- In the Southern Trench (MPA search feature 'shelf deep') two PMFs were observed: 'burrowed mud' (also an MPA search feature) and the 'white cluster anemone', *Parazoanthus anguicomus*. 'Sea pens with burrowing megafauna', (**SS.SMu.CFiMu.SpnMeg**) biotope was observed inside and outside of the Southern Trench 'shelf deep' at 28 stations covering an estimated total area of 225.85 km^2. Sea pens (*Pennatula phosphorea*) were seen in low numbers, possibly indicating disturbance.

- A further seven biotope complexes were recorded in and around the Southern Trench using drop down video and infaunal grabs. These included **SS.SMx.CMx, SS.SMu.Csa.Mu**, **SS.SSa**, **SS.SMu.CFiMu**, **SS.SCS.CCS**, **SS.SMx.CMx.FluHyd** and **SS.SSA.CmuSa**. The most numerous and widespread biotope complex observed was circalittoral fine mud (**SS.SMu.CFiMu**), found at 47 stations.

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Acknowledgements

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SNH is also grateful to SSE for providing access to their survey data collected to inform high voltage transmission projects in the waters off Noss Head.

This project was funded by Marine Scotland as part of the Scottish MPA project.

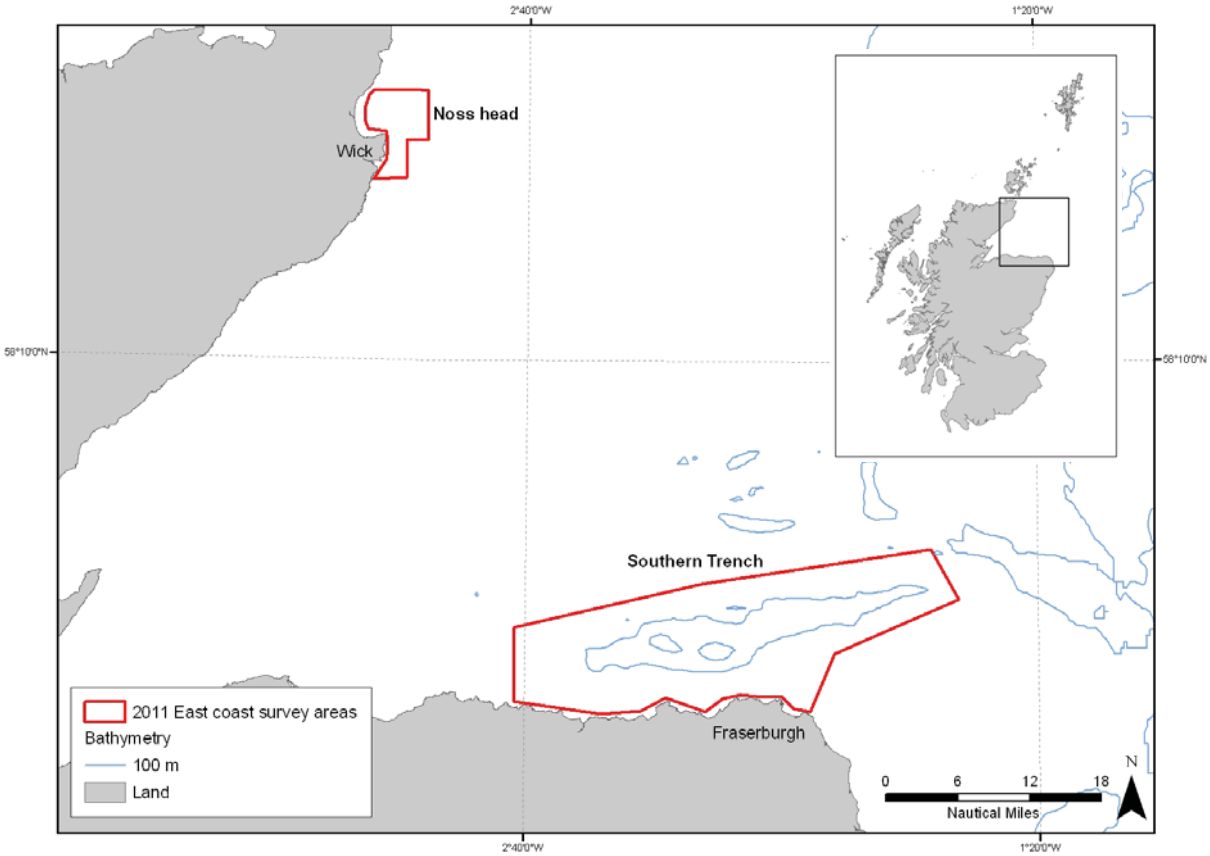
1. INTRODUCTION

Provisions to designate new Marine Protected Areas (MPAs) within Scottish waters have recently been introduced through the Marine (Scotland) Act 2010 and the UK Marine and Coastal Access Act 2009. To help target nature conservation action SNH and JNCC have generated a recommended list of habitats and species of importance in Scottish waters - the Priority Marine Features (PMFs). A subset of the PMFs (MPA search Features) will drive the identification of Nature Conservation MPAs (Marine Scotland, 2011a).

Recent research projects have collated available datasets detailing the distribution of the full suite of MPA search features and PMFs to ensure that the best possible use is made of existing records in the identification of new MPAs. New survey work has also been commissioned to validate their continued presence, in selected areas, and to underpin the development of formal MPA proposals, established using the *Scottish MPA Selection Guidelines* (Marine Scotland, 2011b).

Two areas along the east coast of Scotland were identified for targeted survey work due to the presence of historical records of PMFs and MPA search features. The first of these areas is located just off Noss Head, east of Wick (Figure 1), where, in 2009 a large horse mussel bed was discovered (Triscom, 2010). The second site, the Southern Trench, is located in the outer area of the Moray Firth, (Figure 1). Here one of the largest 'shelf deeps' in Scottish waters is present, a large scale MPA search feature.

Figure 1. 2011 Survey areas: Noss Head and the Southern Trench



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1.1 Survey objectives

The purpose of this study was to undertake a detailed habitat survey of the seabed at Noss Head and the Southern Trench (Figure 1). The survey programme was designed to generate sufficient information on the distribution, quality and extent of the MPA search features present in these locations, to enable SNH to undertake a preliminary assessment of the merits of the 2010 survey area against the *Scottish MPA selection guidelines (*Marine Scotland, 2011b).

The work programme encompassed the following main tasks:

1. Review existing information on the sublittoral MPA search features and PMFs within the two survey areas.

2. Design and undertake a survey programme to ascertain the current distribution, quality and extent of MPA search features and PMFs within the two survey areas.

3. To compare the quality and size of the Noss Head mussel bed to others within Scotland and the UK.

1.2 Noss Head

Noss head is located to the north of Wick in an area of exposed coastline on the north-east coast of Scotland. Wick, once a thriving herring fishing village, has now diversified with North Sea oil interests providing work for those living nearby.

1.2.1 Previous marine biological surveys

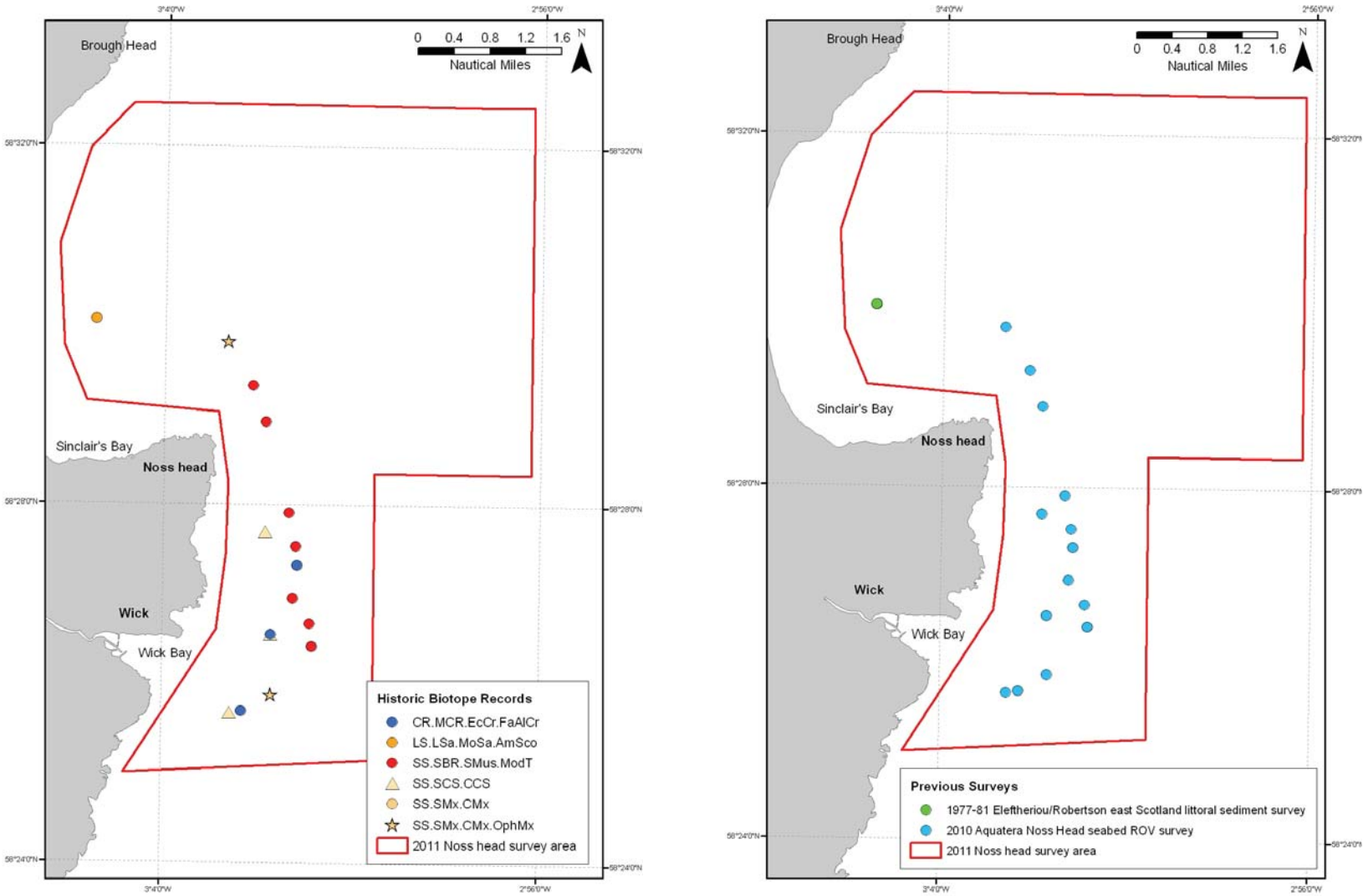
Prior to 2010 there had been relatively little formal survey work carried out in the Noss Head area (Figure 2, Table 1 and Appendix 12). In June 2010, Aquaterra Ltd and Triscom Marine were contracted by Scottish and Southern Electric (SSE) to survey a potential route for the positioning of a new electrical cable and hub platform off the east coast of Wick. A remotely operated vehicle (ROV) was used for this survey. However, no features of conservation interest were observed (Aquatera and Triscom, 2010).

Table 1. Marine biological surveys carried out in the Noss Head area

Year of survey	Organisation	Details	Reference	PMFs/ MPA search feature
1977 – 1981	Nature Conservancy Council	1977-81 Eleftheriou/Robertson east Scotland littoral sediment survey	Report Unpublished (MNCR)	NA
*June 2010	Aquatera Ltd and Triscom	ROV Survey of Potential Cable Route and Offshore hub location in. The survey crew included Roving Eye Enterprises, Aquaterra and Triscom	Report unpublished	None
*Sep-Oct 2010	MMT Consultancy	This carried out geophysical, geotechnical and ROV surveys	MMT 2010	Horse mussel bed
Oct 2010	Trisom Marine	ROV survey to determine the limits of mussel bed and/or find a "patch of least disturbance" through the bed	Triscom Marine (2010) and Moore & Roberts (2011)	Horse mussel bed

* Data not included within Figure 2

Figure 2. Previous surveys and recorded biotopes within the Noss Head survey area



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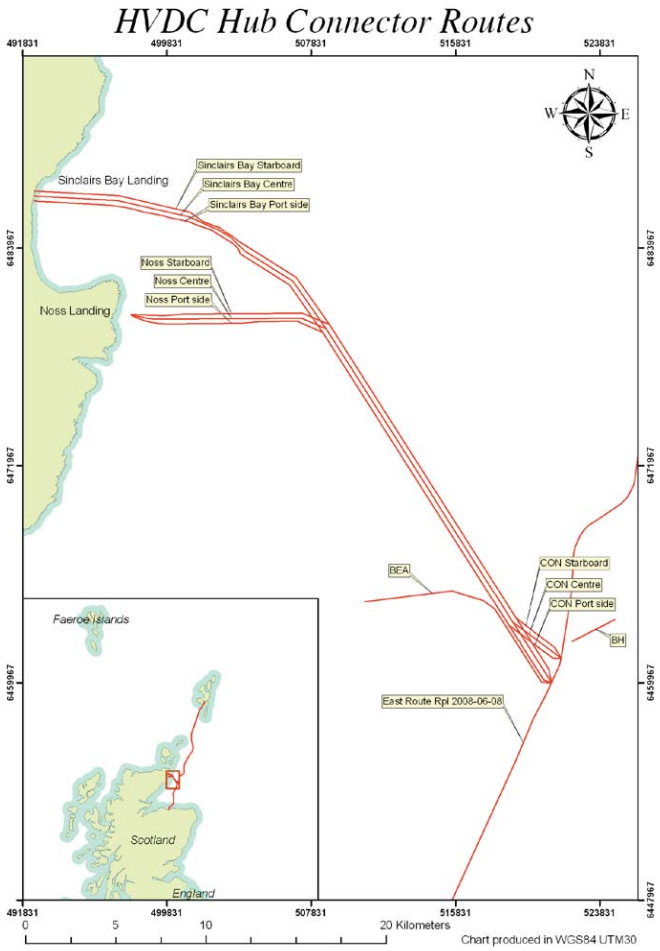
A survey by MMT Consultancy, in September/October 2010, consisted of two main phases, the first of which involved the use of acoustic side scan sonar to survey the geophysical seabed for a cable corridor (Figure 3). Processed data from this phase of the survey were then used to perform a targeted drop down video (DDV) survey. The DDV survey highlighted the presence of a large area of gravel mixed with horse mussel shells (**SS.SMx.CMx**) located 2.8 km from where the proposed cable was to come ashore at Noss Head (Figure 3). The quantity of shell was seen to gradually increase eastwards, becoming a dense horse mussel bed (**SS.SBR.SMus**) approximately 3.2 km from shore. The bed was considered to be diverse with species such as *Ophiothrix fragilis* and *Asterias rubens* recorded as abundant. The greatest density of shells, and species diversity, was observed at depths between 35 m to 45 m with the bed extending east for 850 m where the seabed became characterised by gravel mixed with horse mussel shells and occasionally boulders (**SS.SMx.CMx**). An additional cross-transect was surveyed 700 m in a north to south direction, perpendicular to the proposed cable route. Video from this transect revealed a continuous bed of horse mussels. Analysis of the side scan sonar showed that the extent of the bed, in a north to south direction, was at least 3.5 km long, and in a west to east direction, reached approximately 1 km.

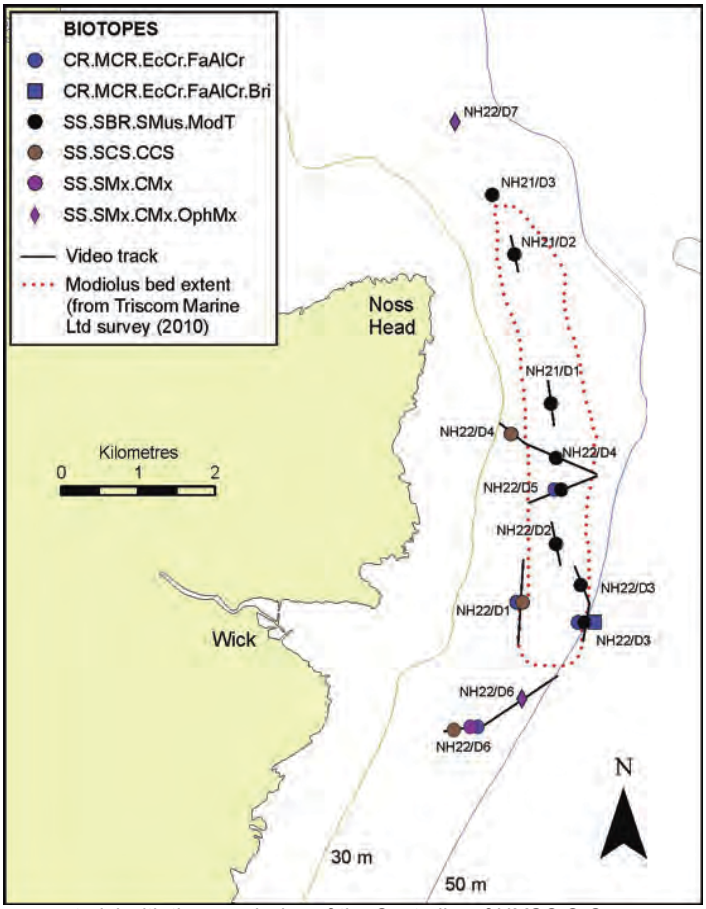
A further survey in October 2010 investigated the horse mussel bed further (Triscom, 2010). The survey highlighted the presence of dense live and dead horse mussel shells and records of associated epifauna such as the brittlestar *Ophiothrix fragilis.* Mapping within the report delineates what was thought to be the eastern and western extents of the bed. Areas were also noted where horse mussels were absent to the west and south of the mussel bed. In addition, analysis of the video footage collected from sampling stations within Sinclair's Bay found no evidence of horse mussels. In conclusion the Triscom report identified the eastern and western edges of the horse mussel bed and also highlighted the absence of horse mussels to the north and south.

Figure 3. Map from MMT (2010) of the proposed cable route at Noss Head (coordinates in WGS 84, UTM30)



In 2011 SNH commissioned a review of a selection of seabed video that had been recently collected at various locations within Scottish waters. As part of this review the video footage collected from the Noss Head area, by Triscom Marine in 2010, was re-analysed (Moore & Roberts, 2011). High drift speeds throughout the available footage resulted in poor video quality which resulted in poor discrimination between live horse mussels and dead shell. Despite this the dominant horse mussel bed feature was confirmed (identified as the biotope **SS.SBR.SMus.ModT**) and was estimated to cover an area 5.7 km long by 0.8 km wide. The exact extent of the bed, especially the northerly and southerly points, was not established. However, an extent of 450 ha (4.5 km^2) was estimated, making the bed potentially the largest known in Scottish waters (Figure 4).

Figure 4. Estimate of horse mussel bed extent from the analysis of Triscom video data (from Moore & Roberts, 2011)



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1.2.2 PMFs/ MPA search features within the Noss Head survey area

The broad habitat type "horse mussel beds" (*Modiolus modiolus*) is listed as both a PMF and a MPA search feature. Horse mussels can form small clumps, extensive sheets, or build up as reef-like structures (Holt *et al*., 1998; Lindenbaum *et al*. 2008). Dense horse mussel reefs are known to support a range of associated fauna and are identified as 'biogenic reefs' under the Habitats Directive description of 'reefs' (http://jncc.defra.gov.uk/page-1448). The diversity of flora and fauna associated with horse mussel reefs make them of high conservation importance. These biogenic structures can be extremely dense, ranging from 4 to 600 mussels per m^2, inhabiting depths of up to 70 m in the UK (Rees *et al*., 2008; Rees, 2009). They can also form on a variety of substrates from cobbles to muddy gravel and sand in moderately tide swept waters.

Factors such as geographic position, habitat availability, and environmental conditions, including current, affect the structure and function of a horse mussel bed (Mair *et al.,* 2000). Different formations of reef may occur depending on the tidal strength and sediment type. Horse mussel reefs often form localised areas of high biodiversity and productivity on parts of the seabed that are otherwise tide swept and sand scoured (Rees *et al*., 2008).

Horse mussel beds are divided into four different biotopes according to Connor *et al*. (2004). These are **SS.SBR.SMus.ModT**: *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata, **SS.SBR.SMus.ModMx**: *Modiolus modiolus* beds on open coast circalittoral mixed sediment, **SS.SBR.SMus.ModHAs**: *Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata, and **SS.SBR.SMus.ModCvar**: *Modiolus modiolus* beds with *Chlamys varia*, sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata. The biotope **SS.SBR.SMus.ModT** is generally found in moderately strong currents or wave exposed areas, typically on open coast such as off Noss Head, but also in tide-swept channels of marine inlets.

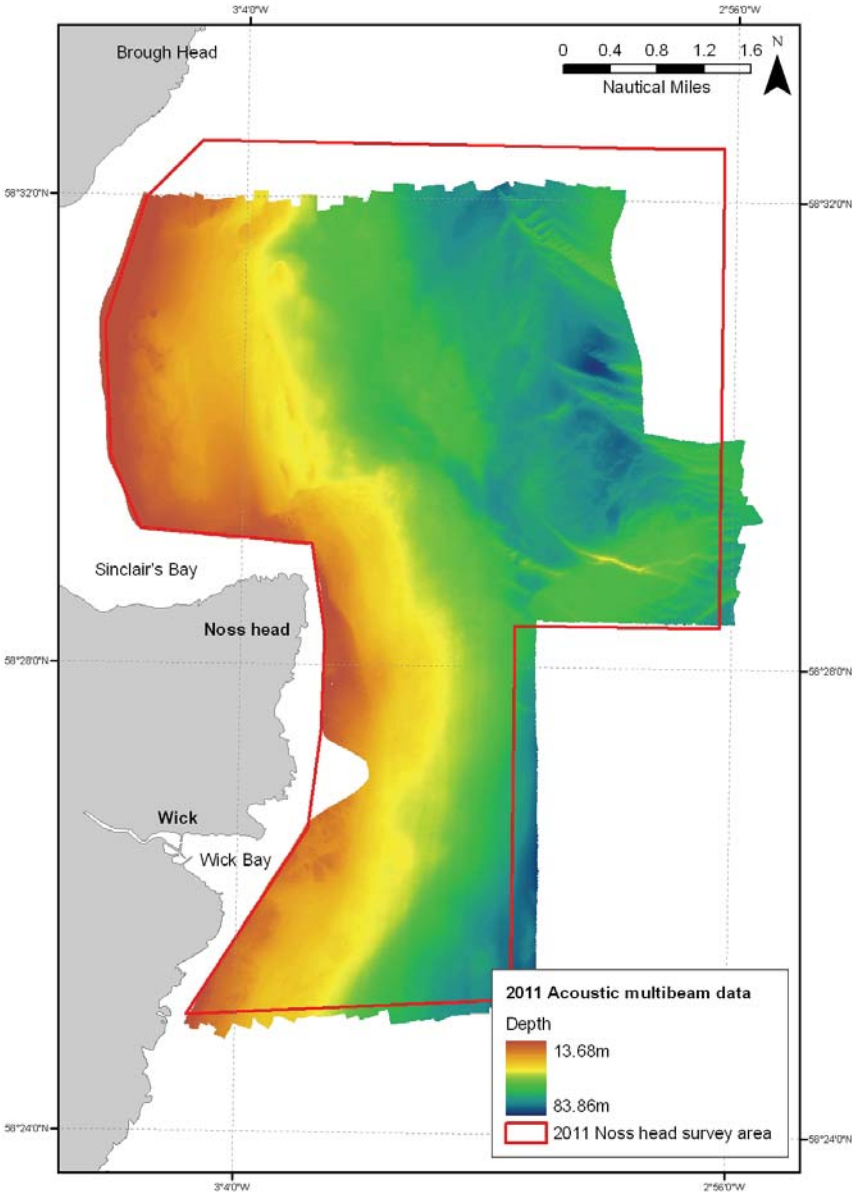
There were no other previous records of PMFs or MPA search features within the 2011 Noss Head survey area.

1.2.3 Geodiversity features

In 2011 (8^{th} to 17^{th} August) acoustic multibeam data were collected by SNH and BGS on board the Northern Lighthouse Board Vessel, *NLV Polestar* within the 2011 Noss Head survey area (Figure 5). A Konsberg EM3002D Multibeam Echosuonder was used with a 200^{0} swath. At least 25% overlap was used through out the acoustic survey to ensure that a minimum IHO order was reached as well as to maximise the amount of seabed covered in the time period. The data collected were processed using CARIS software to produce accurate bathymetry data showing the variable seabed characteristics and structures present in the area.

Due to the timing of the acoustic survey only partially processed data were available for survey planning purposes.

Figure 5. Bathymetry image from acoustic multibeam data collected by BGS and SNH in 2011



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1.2.4 Related human activities

Literature suggests that horse mussel beds may be adversely impacted by mobile fishing practices such as scallop dredging and trawling (e.g. Magorrian & Service, 1998; Strain *et al*., 2012). Within the Triscom report (2010) areas of barren seabed were noted in areas where static gear (creels) were also observed. However, there are no published reports providing evidence of mobile gear within the Noss Head study area and the damage noted cannot be directly attributed to fishing practices.

The proposed cable route may, potentially, have a direct physical impact on the seabed within the Noss Head area. Recovery times due to such activities are likely to be long for biogenic structures such as horse mussel beds. However, this would be subject to the extent

of physical impacts such as pipeline installations, trenching and use of jack up oil rigs (Holt *et al.,* 1998).

1.3 Southern Trench

The Southern Trench is a discrete deep water area along the south of the outer Moray Firth, located 10 km from land between the coastal ports of Banff and Fraserburgh (Figure 1). The morphology of the trench is irregular and is the most topographically complex region in the Moray Firth (Brooks *et al.,* 2011). The Southern Trench is one of approximately 150 similar discrete channels located off the east and north-east coasts of Scotland and is 58 km long, up to 9 km wide and, in places, up to 250 m deep (Bradwell *et al.,* 2008).

1.3.1 Previous surveys

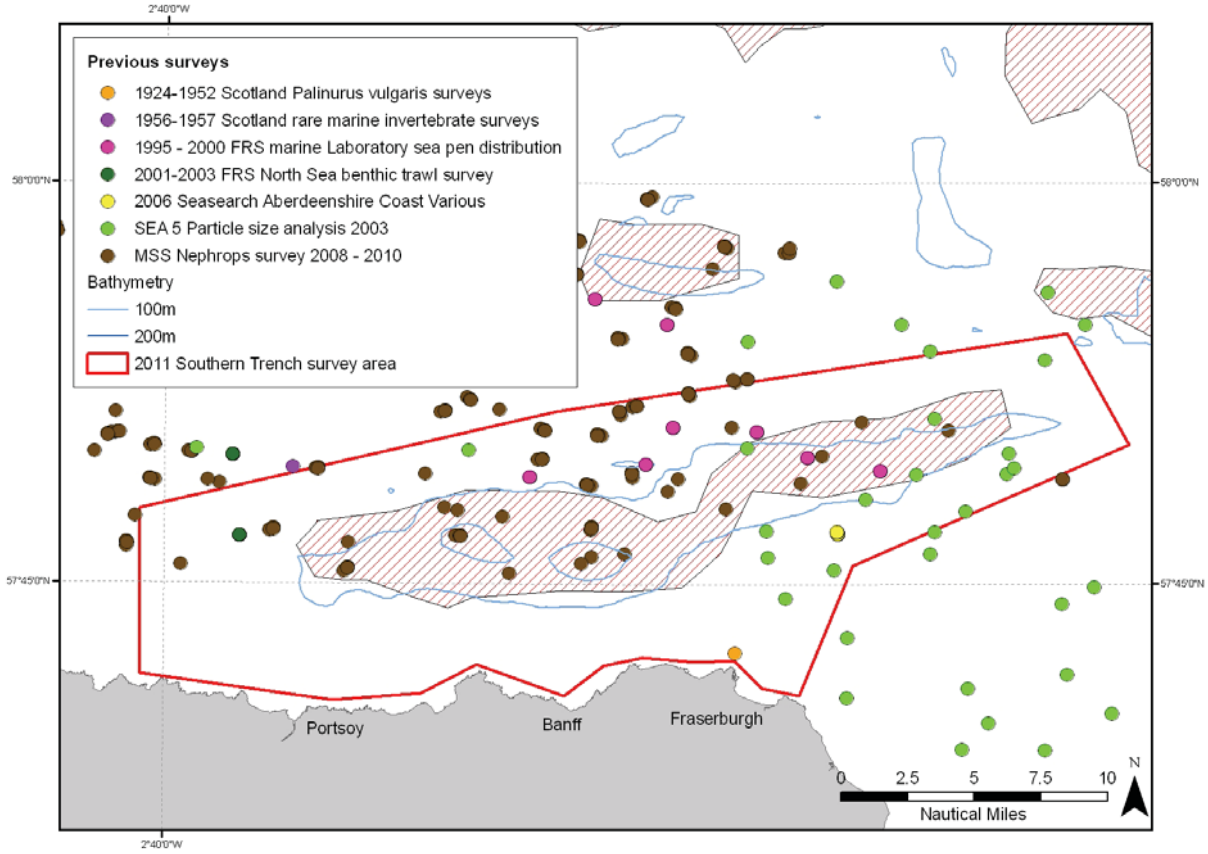
Previous marine biological surveys carried out within the 2011 Southern Trench survey area include those conducted by organisations such as Seasearch, Marine Scotland Science (MSS), and the British Geological Survey (BGS) (Figure 6, Table 2 and Appendix 12). In addition a dedicated cetacean survey was also conducted in 2007 by the Cetacean Research and Rescue Unit.

Table 2. Previous marine biological surveys carried out in the Southern Trench area

Year	Organisation	Survey description	Reference	PMFs/ MPA search Features
2001 - 2003	MSS/FRS	Archived video recordings obtained by MSS/FRS while undertaking *Nephrops norvegicus* stock assessments were re-analysed to obtain data on sea pen distribution.	Greathead *et al*., 2007	SS.SMu.SpnMeg
2003	British Geological Survey (BGS) under contract to Geotek Ltd	Report on the seabed and superficial geology and geological processes in the Department of Trade and Industry (DTI) Strategic Environment Assessment area 5 (SEA5), using data from the DTI 2003 survey including multi-beam bathymetry, side scan sonar, seismic reflection profiles, sea-floor photographs and samples. The report integrates the 2003 survey results with the pre-existing geological reports, maps and other publications in the scientific press.	Holmes *et al.,* 2004	N/A
*2000-2005	Cetacean Research and Rescue Unit	136 cetacean encounters on dedicated boat surveys of an 880 km^2 area of the southern outer Moray Firth between Lossiemouth and Fraserburgh	Robinson and Tetley, 2007	*Balaenoptera acutorostrata* (minke whale)
2005	Seasearch	Diving survey of the wreck of the Remeura	NA	*Molva molva*
2011	MSS	Nephrops stock assessment video from 2008-2010 analysed to determine sea pen abundance	No reference	SS.SMu.SpnMeg

** Data not shown in Figure 6*

Figure 6. Previous surveys that have been conducted within the Southern Trench survey area



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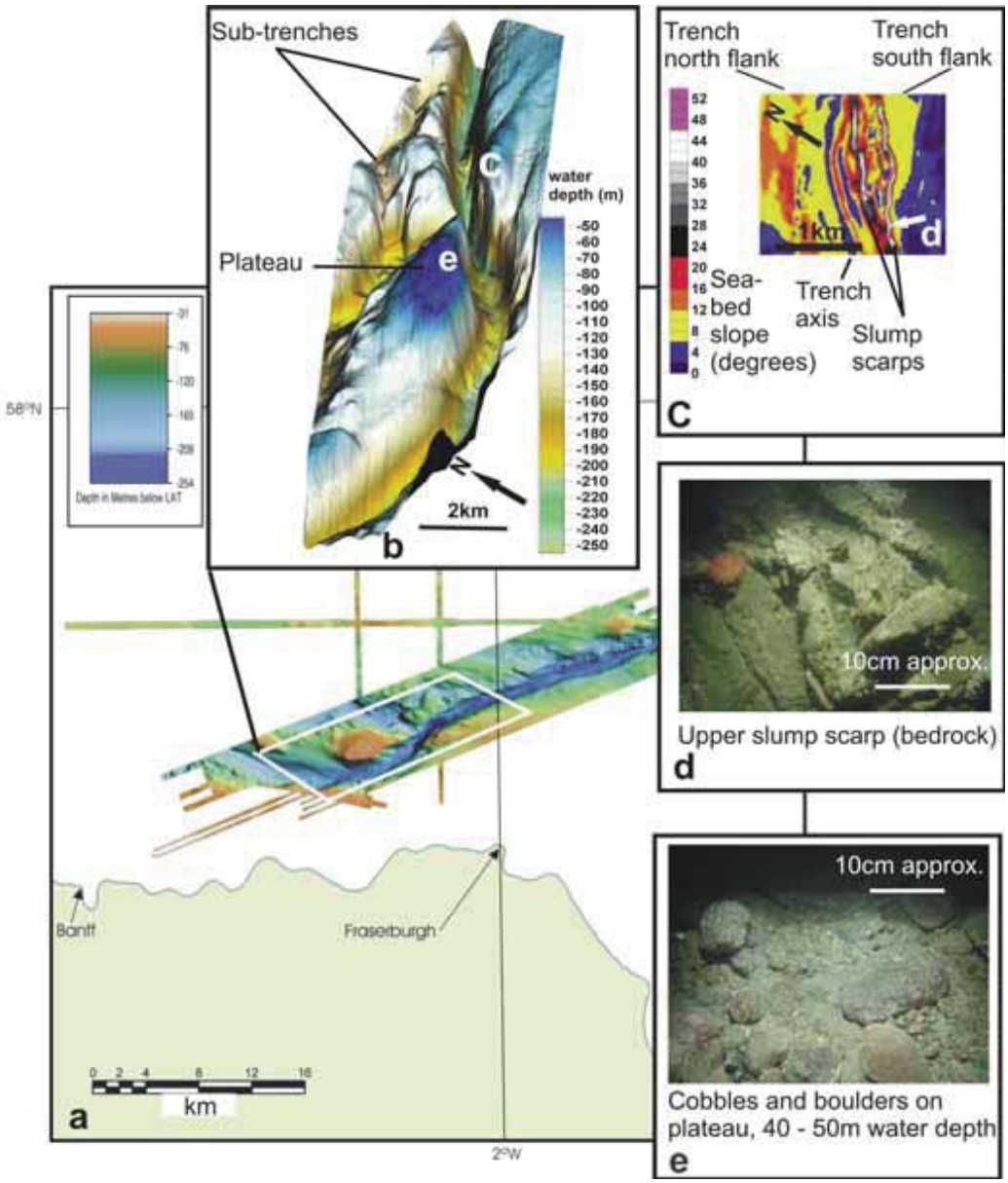
As part of their annual survey programme Marine Scotland Science (MSS) conduct regular surveys to monitor the abundance, age structure and geographical distribution of the principal commercial fish stocks in Scottish waters. The Southern Trench is one such area which has been subject to assessment of *Nephrop* stocks. In 2007 a review of the video collected during these stock assessments was analysed in order to evaluate the distribution of sea pens (Greathead *et al*., 2007). Two species of sea pen, *Vigularia mirabilis* and *Pennatula phosphorea*, were observed. Video from more recent MSS *Nephrop* surveys (2008 – 2010) have also been analysed (not published) and offer a more recent account of the presence of these two species (Figure 6).

As part of the Strategic Environmental Assessment Area 5 work (SEA5; Holmes *et al.,* 2004), detailed surveys were conducted along a section of the Southern Trench focusing on the geology and morphology of the trench and surrounding seabed. This survey involved the collection of samples for particle size analysis as well as scattered drop down video stations and detailed acoustic multibeam data (Figure 7). Results suggest that the Southern Trench is an exceptional example of an enclosed (glacial) seabed basin.

Figure 7. Morphology of the Southern Trench (from SEA5; Holmes et al., 2004)



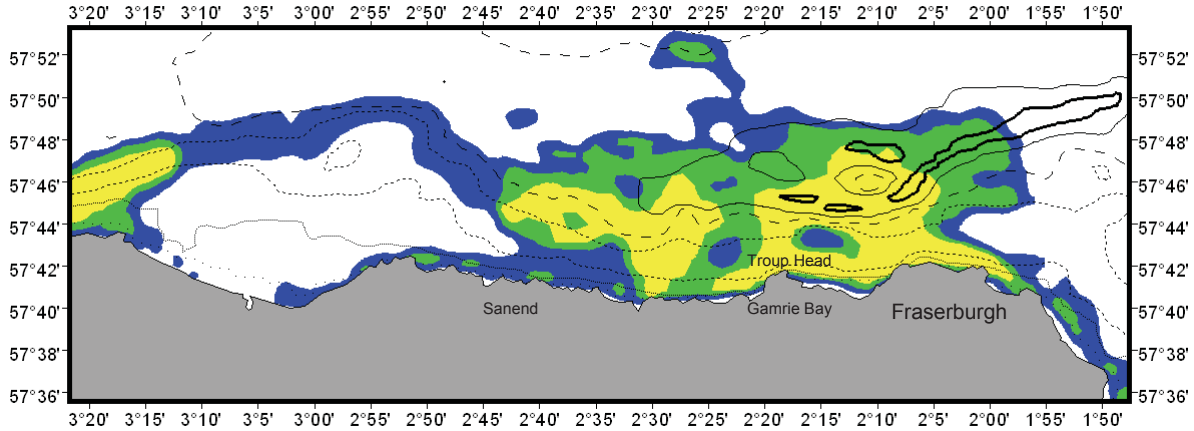
a. colour-shaded topography, DTI survey 2003 b. extract of seabed-terrain model c. example of seabed-slope changes associated with submarine slumps, southern flank d. bedrock at the presumed slip surface of the uppermost slump scarp e. seabed armour of pebbles, cobbles and boulders, extract from extensive photographic survey of the plateau.

As well as the importance of the Southern Trench for its geodiversity value, the surrounding area has also been highlighted as potentially important for aggregations of the minke whale, *Balaenoptera acutorostrata* (Tetley, 2010). The distribution and "environmental associations" of minke whales within the Moray Firth have been studied along the southern embayment between the coast and deep trench areas (Robinson & Tetley, 2007). Several studies have indicated the seasonal movements of minke whale (see Robinson *et al*., 2009) and correlations with surface temperature meso-scale features (Tetley, 2010). Minke whale distribution is not linked to benthic communities in the Southern Trench.

Within the Moray Firth important areas for the conservation of minke whale are thought to include Lossiemouth, Whitehills, Banff and Macduff (offshore to 50 m depth), and the area of

coast between Gamrie Bay, Troup Head, Sandend and offshore to the lower Southern Trench (Tetley 2010: Figure 8).

*Figure 8. Spatial zoning of marine conservation priority for minke whale (*B. acutorostrata*) within the southern outer Moray Firth*, Northeast Scotland (from Tetley 2010)



*Conservation priority determined from modelled Maxent [tm] habitat suitability, with those areas of suitable habitat being divided into inferred **Priority** (determined critical for constant* B.acutorostrata *utilisation), **Buffer** (determined important with respects to spatio-temporal fluctuations in utilisation) and **Corridor** zones (deemed necessary for movement to and between MPAs).*

1.3.2 PMFs and MPA search features

The Southern Trench was identified as an area to be surveyed largely due its geodiversity importance as a 'shelf deep', a large scale MPA search feature (Brooks *et al.,* 2011). Aside from the aforementioned minke whale no other PMFs / MPA search features have been previously recorded in the area. However, MSS recorded sea pens, *Vigularia mirabilis* and *Pennatula phosphorea* throughout the trench, suggesting that the broad habitat 'burrowed mud' is present, and likely to be represented by the component biotope **SS.SMu.SpnMeg** (Table 3).

1.3.3 Geodiversity features

The SNH commissioned report by Brooks *et al.,* (2011) aimed to develop a scientific framework for the assessment of key geodiversity areas against the 'concepts of importance' outlined in the MPA selection guidelines (Marine Scotland, 2011b). The report also identified and documented the key geodiversity areas in Scottish waters using this scientific framework. The Southern Trench survey area was identified as one of these key sites.

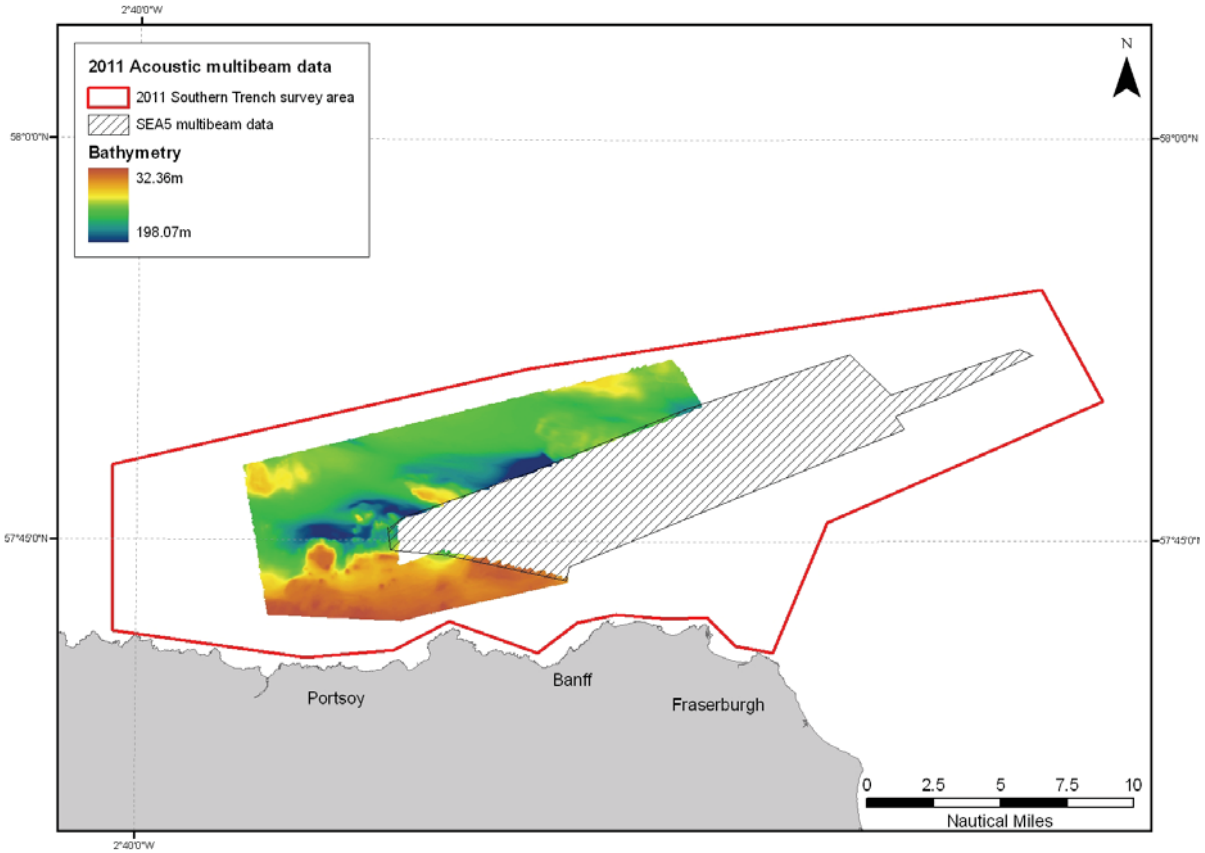
Large-scale seabed incisions are a characteristic feature of the shelf seabed off east and north-east Scotland and the Southern Trench is one of the largest examples of this (Brooks *et al.,* 2011). The Southern Trench is an exceptional example of an enclosed (glacial) seabed basin and is regarded as scientifically important for further understanding of ice sheet drainage patterns in this region; detailed morphological analysis suggest it was formed from at least two erosion events operating in different directions (Brooks *et al.,* 2011). The morphology of the trench is irregular and forms the most topographically complex region of the Moray Firth. Previous surveys using multibeam and single beam echo sounder data (e.g. Holmes *et al.,* 2004) showed this complexity: to the west, the trench is broadly orientated east-west, while to the east, the trench trends in an east-north-easterly direction. This

orientation is broadly similar to other trenches in the outer Moray Firth (Bradwell *et al.,* 2008) and although smaller, these commonly have branching, sinuous courses and a length greater than 10 km. The Southern Trench is unusual in that it is cut through both Quaternary deposits and the underlying bedrock.

The cross-sectional profile of the trench is asymmetric, with a steep north-facing slope and a shallower shelving south-facing slope (Long and Stoker, 1986). The SEA5 multibeam survey (Holmes *et al.,* 2004) revealed that in places the trench is very steep-sided with slope angles of more than 50^{o} and that here is evidence of gravity-driven slumping, slump scarp faces and slide deposits.

In August 2011 acoustic multibeam data were collected by SNH and BGS on board the Northern Lighthouse Board Vessel NLV *Polestar*. The area surveyed was adjacent to that completed for the SEA5 work (Holmes *et al.,* 2005). The processed bathymetry data can be seen in Figure 9. Further information regarding the equipment used can be seen in Section 1.1.3. Only partially processed data were available for survey planning purposes in the present study.

Figure 9. Bathymetry from acoustic multibeam data collected by BGS and SNH in 2011



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1.3.4 Related human activities

Human activities taking place within and around the Southern Trench are largely fishing related. The area to the north of Fraserburgh is heavily used by local creel fisherman and consequently less boat traffic is present due to the large numbers of creel lines and buoys.

Trawling, mainly for *Nephrops*, is also a popular fishing activity within and around the Southern Trench. The *Nephrops* fishery in Scottish waters has developed from a few tonnes in the early 1960s to over 31,000 tonnes in 2009, and *Nephrops* is currently the second most valuable species landed in Scotland (£78.3 million in 2009).

Static and mobile fishing gear is known to have a direct impact on the seabed (e.g. Kaiser *et al*., 2006) and also affect cetaceans. The most likely possible effects on minke whale populations within the Southern Trench survey area are by-catch and habitat degradation. To mitigate impacts and sustainably manage the economic benefits of the dolphin watching industry, the Dolphin Space Programme (Woods-Ballard *et al*., 2003) has been developed.

2. METHODS

Between the 2nd and 13th of September 2011 a collaboration of scientists from Heriot Watt University, Scottish Natural Heritage (SNH) and Marine Scotland Science (MSS) undertook a survey using drop down video (DDV), stills photography and Day grabs aboard *RV Alba na Mara* (for details see the survey log in Appendix 14). ROV deployment was also scheduled but faults in the propulsion system and power failures meant that it was not used in this survey. All original data records used uncorrected depth and were later amended during video analysis to depth below sea level, taking into account the 4.3 m draft of the *Alba na Mara*.

2.1 Video Survey

A Konsberg OE14-366 colour zoom camera was used alongside a Konsberg 14-208 digital stills camera. The camera and lights were mounted onto a sledge and a 600 m load-bearing polyurethane umbilical cable was used on a TV winch (Figure 10).

Figure 10. T.V. sledge and camera equipment used for DDV tows

.

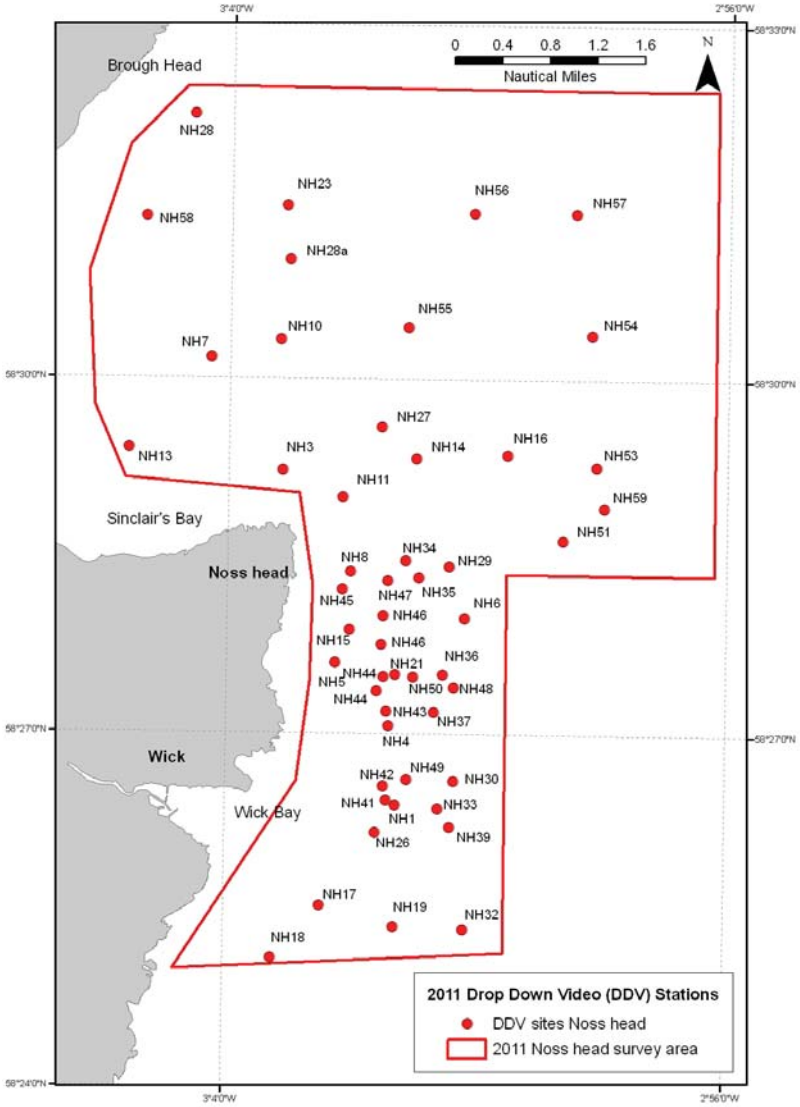
In all deployments the sled obtained 5 -10 minutes of footage. Immediately prior to video deployment, a ‘clapper board’ with the date, time and station number was recorded on the video tape to mark the start of each new tow. When the camera was settled on the seabed,

the position (WGS 84 Datum), start time (GMT), and depth (from ship's computer), were recorded in the manual log (Appendix 1 and 2). The video recording started at the same time. The sled was then towed at 0.5 - 1.0 knots across the seabed either by drifting with the current or using the drive of the vessel to compensate for prevailing sea state and tidal conditions. During each deployment, substrate type and main taxa were recorded onto the field log. At the end of each transect the end position, depth and time were logged. Stills were taken manually every minute (approximately) and the number of stills was recorded in the field log. Video footage was recorded to Mini DV tape using a Sony GV-D1000 mini DV portable video. Mini DV tapes were backed up to DVD.

2.1.1 Noss Head video survey

Fifty-one video stations were targeted within the Noss Head survey area (Figure 11). Survey stations were chosen using a stratified random coarse grid pattern with a higher density of stations around the horse mussel records. The recently collected bathymetric multibeam data were also used for planning purposes.

Figure 11. Noss Head drop down video (DDV) sampling stations



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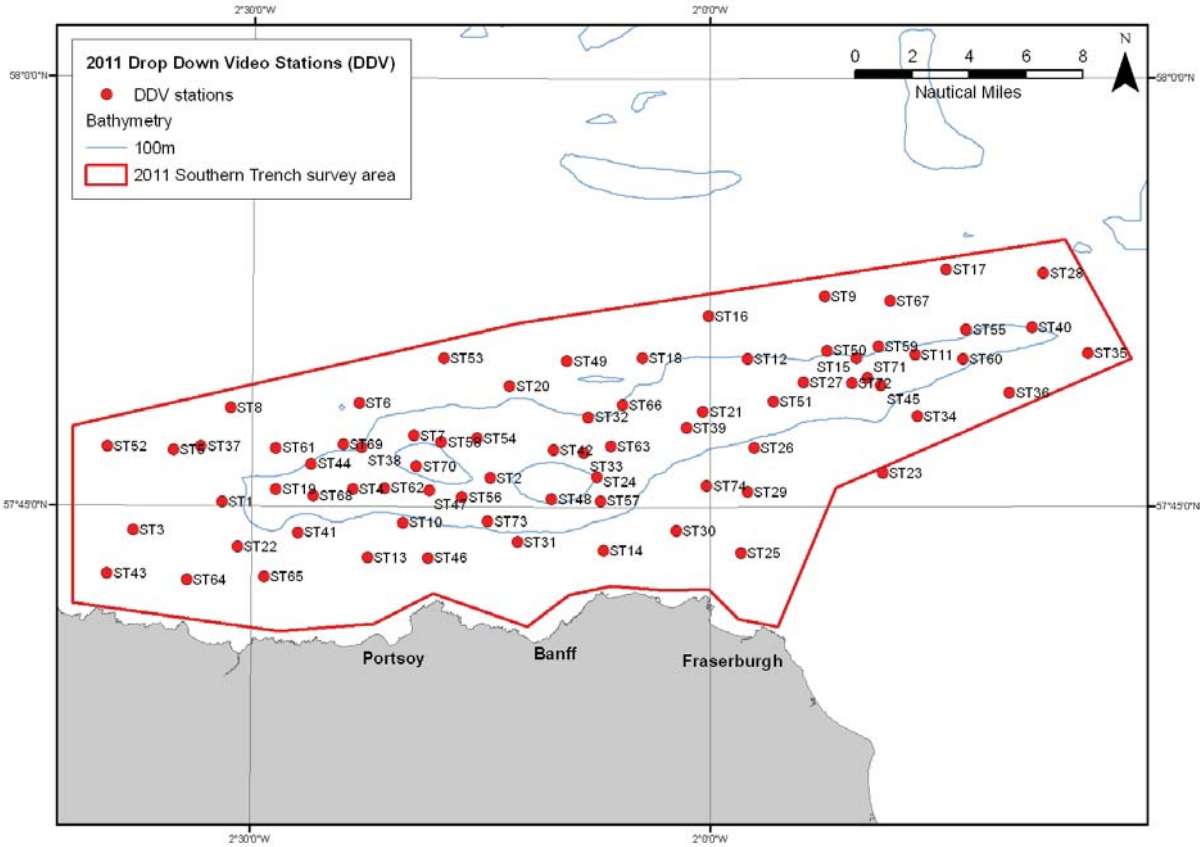
2.1.2 Southern Trench video survey

Seventy-four video stations were completed within the Southern Trench and surrounding plateau (Figure 12). Again, survey stations were chosen using a stratified random coarse grid pattern with a higher density of stations in the most likely PMF areas, taking into account historic particle size analysis (PSA) data, bathymetric multibeam data, and macrobenthic survey records. A small number of pre-planned sampling station sites had to be moved due to a high number of creels obstructing the safe deployment of the DDV.

Figure 12. Southern Trench drop down video (DDV) sampling stations



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2.2 Infaunal survey

A subset of the drop down video sampling stations were pre-selected as grab sampling stations so as to represent the range of likely sedimentary habitats. A 0.1m^2 Day grab was deployed once at each sampling station with a small sub sample of each grab taken for Particle Size Analysis (PSA). Before emptying the grab a ruler was used to measure sediment depth to confirm that the sample was of an acceptable volume. For mud the sample was required to be no less than 7 cm, and for hard packed sands no less than 5 cm deep (Rumohr, 1990). In addition, if the mouth of the grab was found to be open once it reached the surface, then the sample was rejected. A maximum of three attempts were permitted at each grab sampling station.

Once on board the grab was placed into a secure stand with a receiving container underneath. After checking the sample was acceptable a visual inspection was made

recording the following: type of sediment, colour, and depth of redox potential difference (RPD) layer, depth of sample, texture / presence of surface features, and a photograph was taken (Appendix 10).

Once the sample had been inspected the contents were emptied into the receiving tray, and the inside of the grab rinsed through to ensure the entire sample was collected. Care was taken not to wash sediment from the outside of the grab into the sample. The grab was washed between deployments to prevent cross contamination of samples.

A waterproof label was added to the sample stating the survey and location name, station, and date. The sample was then processed using a 1 mm sieve over a sorting table. Contents of the sample retained after sieving were placed in a sample bucket with the corresponding waterproof label and sealed. The sample bucket was then labelled and the contents preserved in buffered 4% Formaldehyde solution. Photographs of the sample in the grab and post processing were taken (e.g. Figure 13) and logged in the grab field log (Appendix 10).

Figure 13. Southern Trench grab sample (STG8). Photographs before and after processing.

A total of 10 infauna sampling stations were selected within the Noss Head survey area (Figure 14, Appendix 8) to target the range of likely sedimentary habitats as well as the horse mussel bed. Due to the nature of the consolidated horse mussel bedform, the Day grab was ineffective for retrieving samples from this habitat, as was a pipe dredge.

A total of 20 infauna sampling stations were selected within the Southern Trench survey area using a stratified random coarse grid pattern to increase sampling effort in areas where PMFs were most likely (Figure 15 and Appendix 9). Overall, sampling aimed to gain a broader understanding of the range and variation of habitat types at different depths.

Figure 14. Noss Head grab survey stations

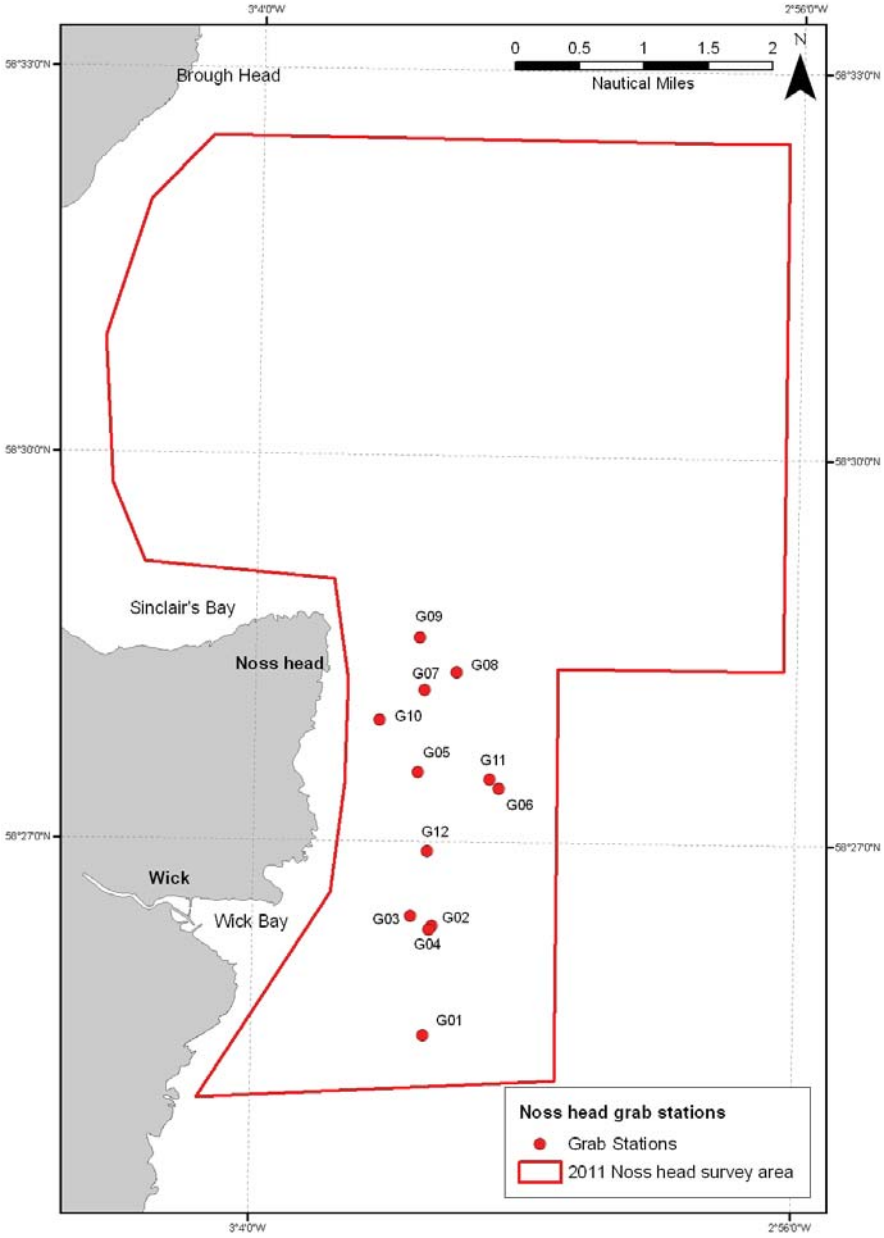

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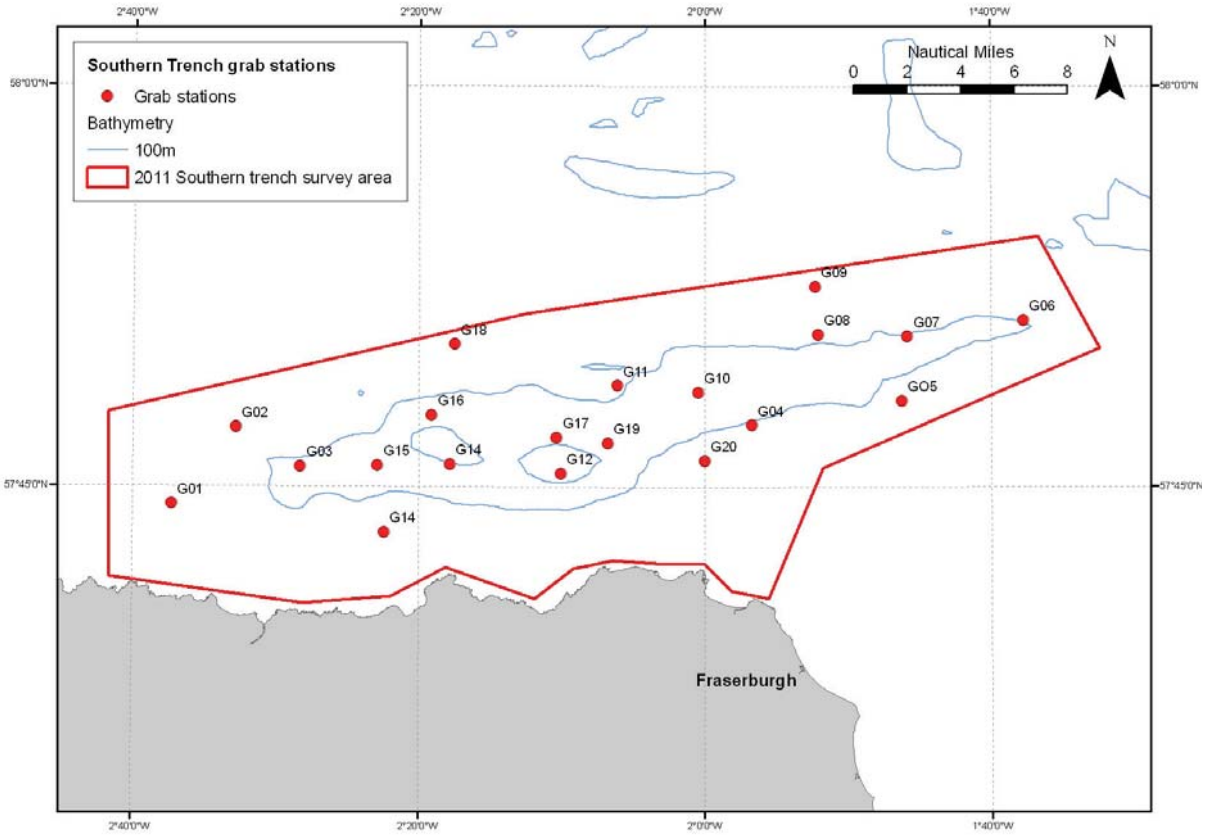
Figure 15. Southern Trench grab survey stations



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2.3 Analysis of drop down video

All video footage was analysed using Adobe Premier Pro. The proportions of different substrate types, and the species present were recorded using either numerical abundance of individuals or SACFOR scales of colonies and larger aggregations of individuals (see Hiscock, 1996). Biotopes were allocated according to Connor *et al*. (2004) (Appendix 4 and 5). The presence of PMF / MPA search features was specifically noted for each tow.

Where an obvious biotope change occurred along a transect a new record was begun and species counts re-started. Both biotope records from the same tow were labelled separately e.g. NH1 and NH1a. Still images were used to increase confidence and resolution for the identification of taxa. For quality control purposes 10 % of all video tows were independently scored and discrepancies between records used to reconcile records from the tow or to re-analyse all tows from a similar habitat type (depending on the type of error). No biotope codes had to be changed below level 5 classification (Connor *et al*., 2004).

2.4 Analysis of infaunal samples

Grab samples were analysed for infaunal species with a sub sample undergoing particle size analysis (PSA). Biotopes were allocated to grab stations according to Connor *et al*. (2004), by accounting for key species presence and abundances with PSA descriptions from the grab samples.

2.4.1 Infaunal analysis

Infaunal organisms were processed in the laboratory after the survey. Each sample was split into a light and coarse fraction, by repeated elutriation over a 0.5 mm mesh sieve. The light fraction was further divided into material retained on a 1.0 mm mesh and the smaller fraction separated. Each fraction was then examined in a petri dish under a dissecting microscope and individual macrofaunal specimens were extracted using forceps. The coarse fraction was also separated using a 2.0 mm mesh. This 2.0 mm fraction was examined in an enamel tray, using magnifying goggles, and the fauna extracted. The remaining coarse material was examined in the same way as the light fraction, under a dissecting microscope. All extracted fauna was identified as far as was practical, using the available literature. A voucher collection was also retained and sent to the Scottish National Museum for quality assurance and reference purposes.

Infaunal species and abundance data were analysed using the statistical package PRIMER v6 (Clarke & Warwick 2001). Data were square root transformed and Bray Curtis similarity data was subjected to a similarity profile (SIMPROF) analysis to determine whether there was any structure in the data. Similarity percentage (SIMPER) analysis was then used to examine the species that most contributed to difference between groups.

The infaunal species data were also used to aid biotope assignment by comparing key species and their abundance with species recorded from DDV footage at the same locations.

2.4.2 Particle size analysis

Particle Size Analysis (PSA) was conducted following The National Marine Biological Analytical Quality Control Scheme (NMBAQC)'s "Best Practice Guidance notes" (Manson, 2011). Each sample was stirred to homogenise the sample with a spatula. Live and dead shell was removed from the sample. A subsample of approximately 100 g (mud and sand), or a minimum of 200 g for gravel was taken. A glass petri dish was pre-weighed to 2 decimal places; this measurement was then subtracted from future measurements.

The sample was placed in the pre-weighed petri dish and dried in a drying oven at around 60°C for 24 hours. The sample was allowed to cool for approximately 5 minutes then re-weighed. The first few samples were put back into the oven for another 24 hours and then re-weighed. If they had lost more water (got lighter) then the drying process was repeated until the mass was stable. This then gave a bench mark for drying times of the remaining samples.

Each sample was wet sieved through a 63µm sieve, using distilled water and 3 - 5% sodium hexametaphosphate. The contents of the sieve were washed back into the beaker and dried again for 12 hours, then re-weighed. This weight minus the first dry weight gave the fine fraction (<63µm). The 63µm sieve was gently cleaned and allowed to dry.

The coarse sample (>63 µm) was added to the top sieve of a clean sieving stack, and left running for 20 minutes. Each of the sieved fractions were weighed, with any material that fell through the final 63µm sieve added to the original (<63µm) fine fraction.

The percentage of each size fraction was classified according to the Wentworth scale e.g. 0.9 % Medium sand (grain size of 250-500µm). This allowed the overall average grain size to be used in the modified Folk triangle soft sediment matrix (Connor *et al*., 2004), to help aid in biotope classification.

3. RESULTS

A total of 17 biotopes were recorded within the two survey areas using both DDV and grab sample analysis (Table 3, Figure 16). Habitat descriptions, biotopes and PMF records for the 125 stations are summarised in Section 3.1, for Noss Head, and Section 3.2, for the Southern Trench.

3.1 Noss Head

3.1.1 General description

Fifty-one drop down video deployments were carried out in the Noss Head survey area ranging in depth from 22 m - 67 m. A total of nine biotopes were recorded using DDV and grab sampling (Table 3, Figure 13). Field notes taken during the video deployments can be seen in Appendix 2 with a more detailed description of the analysis of the video transects in Appendix 4. A photographic inventory of the biotopes listed in Table 3 can be referenced in Appendix 6.

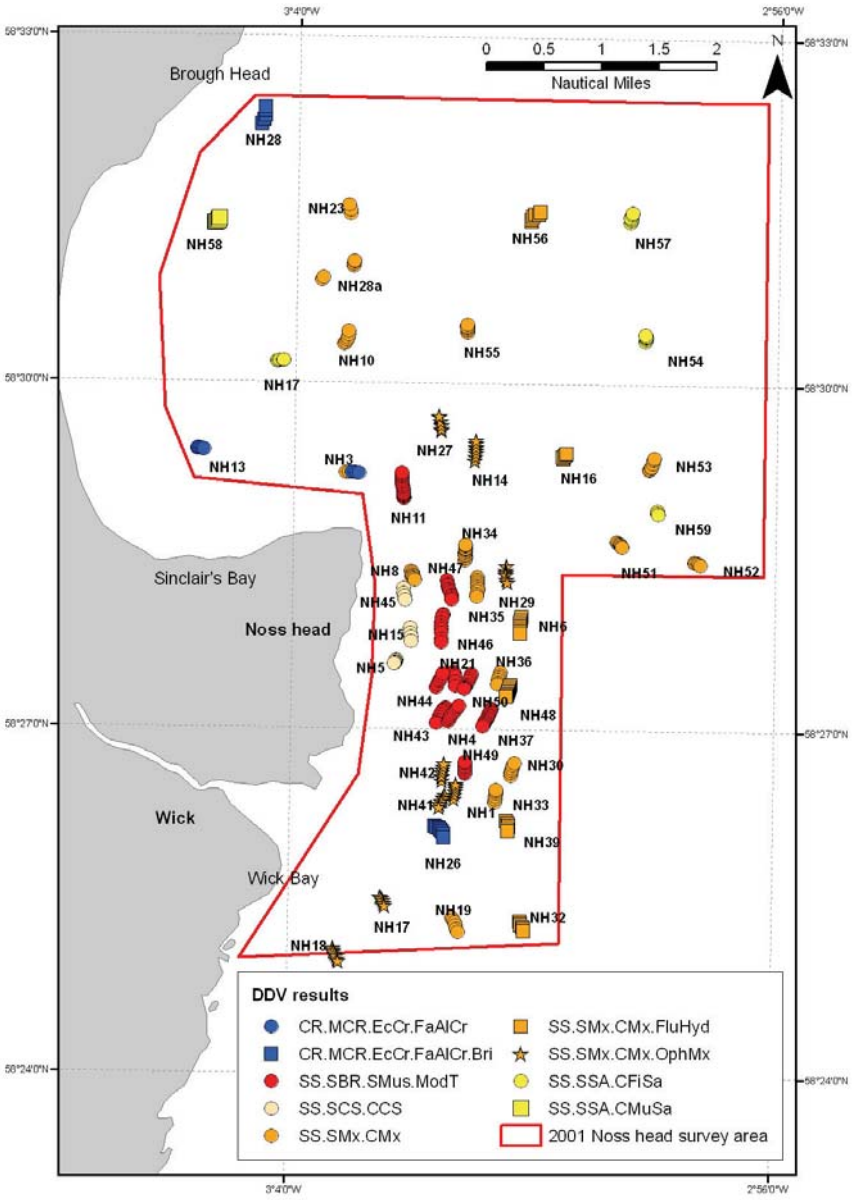
Table 3. Biotope classification descriptions for Noss Head stations (based on Connor et al., 2004)

Rock biotopes (IR = infralittoral rock; CR = circalittoral rock)		**Sublittoral Sediment biotopes** (SS)
High energy infralittoral rock (HIR)	High energy circalittoral rock (HCR)	Sublittoral coarse sediment (SCS)
Moderate energy infralittoral rock (MIR)	Moderate energy circalittoral rock (MCR)	Sublittoral sand (SSa)
Low energy infralittoral rock (LIR)	Low energy circalittoral rock (LCR)	Sublittoral mud (SMu)
Feature of infralittoral rock (FIR)	Feature of circalittoral rock (FCR)	Sublittoral mixed substrata (SMx)
Examples IR.HIR = Habitat complex (level 3 in classification)		Sublittoral macrophytes on sediment (SMp)
IR.HIR.KFaR = Biotope complex (level 4 in classification)		Sublittoral biogenic reefs on seds (SBR)
IR.HIR.KFaR.**LhypR** = Biotope level (anything longer = sub-biotope)		

Biotope	Description	Count
CR.MCR.EcCr.FaAlCr	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock	1
CR.MCR.EcCr.FaAlCr.Bri	Brittlestar bed on faunal and algal encrusted, exposed to moderately wave-exposed circalittoral rock	2
SS.SCS.CCS	Circalittoral coarse sediment	3
SS.SSa.CMuSa	Circalittoral muddy sand	1
SS.SSa.CFiSa	Circalittoral fine sand	4
SS.SMx.CMx.FluHyd	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment	6
SS.SMx.CMx	Circalittoral mixed sediment	15
SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	8
SS.SBR.SMus.ModT	*Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata	10

The most frequently recorded biotope complex within the Noss Head survey area was 'circalittoral mixed sediments' (**SS.SMx.CMx**) which was observed at 29 stations (Figure 16). Sublittoral sands and muddy sands (**SS.SSa)** biotopes were observed at five stations between 20 m and 63 m. Other biotope complexes observed included moderate energy circalittoral rock (**CR.MCR)** and sublittoral coarse sediments (**SS.SCS),** although these were observed in low numbers. Stations of the soft sediment biotope complex **SS.SCS** were only found close inshore in shallow waters between 22 m and 28 m. The rest of the survey area showed no distinct pattern of biotope types with the exception of the horse mussel bed, which was surrounded by a mixture of hard substrate biotope complexes: **SS.SMx.CMx** and **CR.MCR**. Soft sediment biotopes (**SS.SSa**) were found at scattered sites in Sinclair's Bay.

Figure 16. Distribution of PMF and non-PMF biotopes recorded during the 2011 survey off Noss Head, and historic records of PMFs from the area



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3.1.2 PMFs / MPA search features observed

A single MPA search feature was observed within the Noss Head survey area: The horse mussel bed biotope **SS.SBR.SMus.ModT** was recorded at 10 stations (Figure 16). On analysis of the video the bed, although patchy in places, showed the horse mussels covered an area of approximately 2.5 km^2 (Figure 17) within an area of 5 km by 1 km. At NH4 (central bed), and NH44 (western edge of bed) horse mussels were 'frequent' (1-9 / 10 m^2). At another six stations (NH11, NH46, NH37, NH50, NH43 andNH49) they were 'abundant' (1-9 / m^2), and at a further two central stations (NH47 and NH21) they were 'super abundant' (1-9 / 0.1m^2: see SACFOR scale; Hiscock, 1996). Overall there was a lack of obvious pattern in the patchiness to the horse mussels, with areas where they were frequent, abundant or superabundant interspersed throughout the bed extent.

Surface sediment composition in these areas (where visible) was ~90% dead shell with <5% mud, medium / coarse grained sand, or gravelly shell. The **SS.SBR.SMus.ModT** biotope

was recorded between 37 m and 47 m. Neighbouring stations with the biotope **SS.SMx.CMx** may have contained some live *M. modiolus* but this was not visible on the video footage. Large expanses of dead shell around the main bed suggested that it may previously been more extensive or that shell has been washing off the bed for a prolonged period of time. Areas of exposed underlying mud were seen on one tow NH43, suggesting an area of recent physical damage.

The horse mussel (*M. modiolus*) bed biotope supported numerous species (Table 4, Figure 18) including *Ophiothrix fragilis* (F-S), encrusting sponges (R-C), the hydroids *Sertularia cupressina* (O-S), *Abietinaria abietina* (R), *Halecium* sp. (R-A), and *Kirchenpaueria pinnata* (O-S) and occasional bryozoan species including *Parasmittina trispinosa*. Mobile macrofauna were dominated by *Echinus esculentus* with occasional *Cancer pagurus*, *Pagurus bernhardus, Crossaster papposus, Asterias rubens* and holothurians such as *Neopentadactyla mixta* and *Cucumaria frondosa*. Table 5 shows abundance of species at each *M. modiolus* biotope station. There were no conspicuous spatial patterns in species abundances in the different parts of the bed. A full description of the video station is provided in Appendix 4.

Figure 17. Distribution and approximate extent of the horse mussel bed at Noss Head

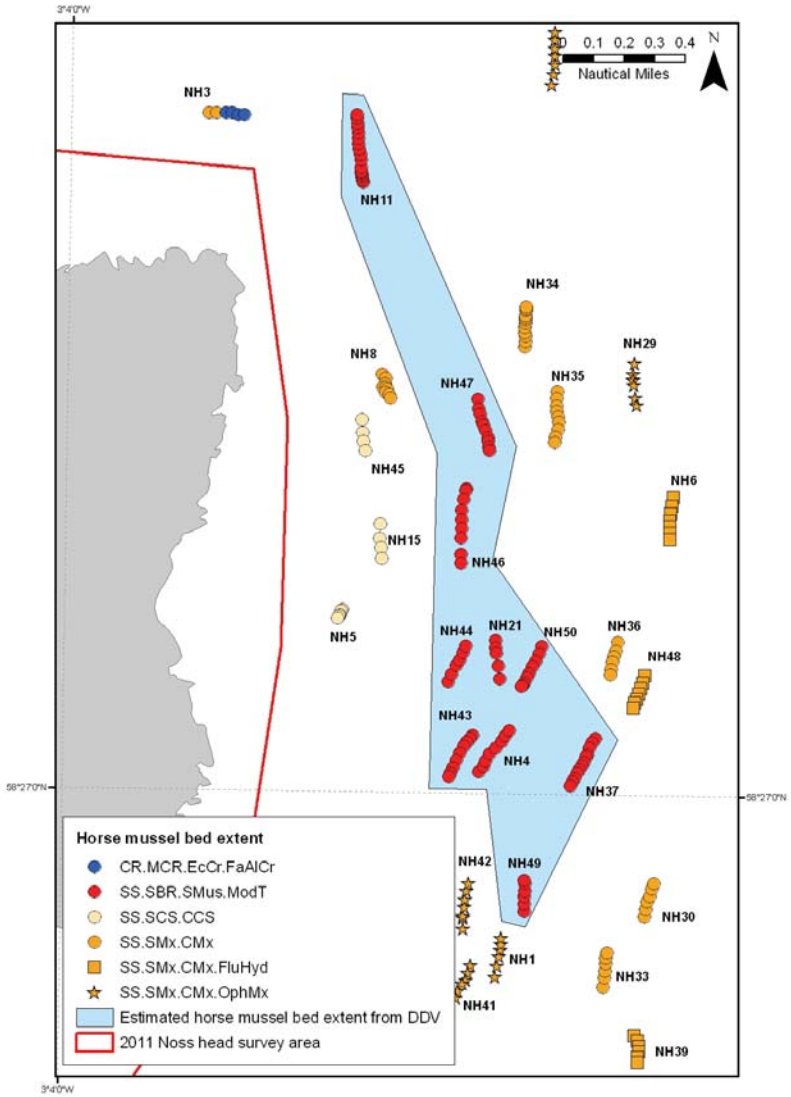

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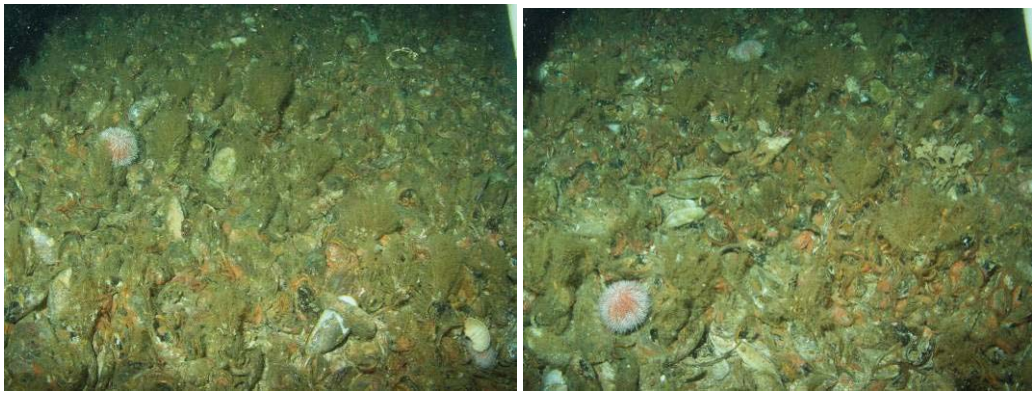
*Figure 18. Still images of horse mussel (*M. modiolus*) bed off Noss Head*



NH46 (Photo CRW_3905) *NH11 (Photo CRW_3834)*

Table 4. Horse mussel bed species abundance data from DDV. Details of species abundance from the remaining stations surveyed at Noss Head can be found in Appendix 6.

Species	**NH11**	**NH46**	**NH43**	**NH44**	**NH37**	**NH50**	**NH4**	**NH49**	**NH47**	**NH21**
Porifera indet. (encrusting)	O	R	C	O	R	C	C	R	R	
Myxilla sp.						R	O		C	
Halecium sp.	F	A	A	R	F	R		O		
Kirchenpaueria pinnata	F	A			F	C	F	O	S	F
Nemertesia antennina	R									R
Abietinaria abietina	R				R		R			
Abietinaria filicula?		R								
Hydrallmania falcata	R		R							
Sertularia cupressina	O	A	S	A	A	A	F	F	C	
Hydroidea sp.				R						
Alcyonium digitatum	O	R								
Lineus longissimus							1			
Spirobranchus triqueter	O	O			O			R		R
Pagurus bernhardus	1	4	2	1	1		5		1	
Cancer pagurus	2	1	5	4	4		7	2	4	
Buccinum undatum			2				1			
Modiolus modiolus	A	A	A	F	A	A	F	A	S	S
Aequipecten opercularis	3				1					2
Pecten maximus	2									
Flustra foliacea	O				C				R	
Parasmitina tripspinosa	O		R							O
Schizotricha frutescens				O					S	
Omalesecosa ramulosa		R				R	R			

Species	NH11	NH46	NH43	NH44	NH37	NH50	NH4	NH49	NH47	NH21
Antennella secundaria						R				
Bryozoa indet crusts			R	R		R	O	R		
Luidia ciliaris	1				1					
Solaster endeca									1	
Crossaster papposus	5	3	3	4	6	2	2	1		
Henricia sp.	10	12	12	3	1	27	8	4	12	2
Asterias rubens	16	24	56	36	26	37	9	26	5	8
Hippasteria phrygiana		2		2		1				
Asteroidea sp.				1						
Ophiothrix fragilis	A	F	A	A	A	A	A	A	S	S
Ophiocomina nigra	S				S				S	
Ophiura albida					F					
Echinus esculentus	112	96	140	126	111	120	130	73	48	24
Neopentadactyla mixta				1						
Cucumaria frondosa					6	1			1	
Holothuria sp.								1		
Ascidia virginea		2	3			8	5		14	4
Squalus acanthias						1				
Anguilla anguilla?			1							
Myoxocephalus scorpius	1	3	3		3	2	1	1	4	1
Pholis gunnellus			1			1				
Pleuronectidae indet.						1				
Pisces indet.						1				
Egg Case indet.										1
Rhodophyceae indet	R									

3.1.3 Distribution of other biotopes

Other biotopes, not listed as a PMF or MPA search feature, were also recorded within the Noss Head survey area. The brittlestar bed biotope **SS.SMx.CMx.OphMx** was recorded at eight stations, three of which were located to the north-east of the horse mussel bed and three along the southern edge of the bed extent (Figure 16). Typically, the sediment composition among the **SS.SMx.CMx.OphMx** stations was estimated to be approximately 40% cobbles, 40% pebbles, 10% stone gravel, 5% shell gravel, and 5% coarse / medium grain sand and dead shell. The **SS.SMx.CMx.OphMx** biotope supported a range of epifauna species but was dominated by dense *O. fragilis* and *Ophiocomina nigra* (C-S). Other species recorded included *Alcyonium digitatum* (A), encrusting sponges (R-O), *Flustra foliacea* (O), *Spirobranchus triqueter* (F), hydroid and bryozoan sp. (O-R). Mobile fauna was dominated by *E. esculentus* with rare occurrences of *C. pagurus*, *P. bernhardus, C. papposus* and *A. rubens.* There was no conspicuous geographic variation in species composition and abundances between **SS.SMx.CMx.OphMx** stations.

The circallitoral mixed sediment biotope complex **SS.SMx.CMx** was recorded at 15 stations spread throughout the survey area, between 19.7 m - 60.7 m depth along the eastern edge of the *M. modiolus* bed (Figure 16). Sediment composition was ~ 80% dead shell, 10% shell gravel and the rest composed of poorly sorted sands. The **SS.SMx.CMx** biotope complex supported species including encrusting sponge (R-O), *F. foliacea* (F)*, S. triqueter, P. tripspinosa* (R-C), hydroid species including *Nemertesia antennina* and *Hydrallmania falcata* (R-F), bryozoans (R-O) and *Lanice conchilega* (O). The mobile fauna was dominated by *E. esculentus* (C) with *C. pagurus* (R), *P. bernhardus, C. papposus, A. rubens and O. fragilis* (C-A) and *Munidia* sp. (R).

The coarse sand biotope complex **SS.SCS.CCS** was recorded at three stations (Figure 16) on the western, inshore edge of the *M. modiolus* bed, between 31.4 m - 36.8 m depth. This biotope consisted of ~ 80% coarse sands with medium sand (~ 10%) and fine sand and gravel (<5 %) making up the rest. The **SS.SCS.CCS** complex had epifauna consisting of *E. esculentus*, *P. bernhardus*, *A. rubens* and *Alcyonidium diaphanum* (R) and the sand eel *Hyperoplus lanceolatus was* occasionally seen.

The tide swept circalittoral mixed sediment **SS.SMx.CMx.FluHyd** biotope was recorded at six stations (Figure 16) towards the eastern side of the survey area between 53 m - 68.4 m depth. These stations were dominated by mixed sediment including boulders cobbles and pebbles, however, unlike the **SS.SMx.CMx** biotope complex records (above), a conspicuous epifaunal community was present and dominated by *F. foliacea* (R-A), *E. esculentus* (C), *S. triqueter* (O-A), hydroids (R-C) and bryozoans (R).

Faunal crusts were recorded on circalittoral rock **CR.MCR.EcCr.FaAlCr** at two stations (NH3B, NH13) inshore and to the west of the survey area in 36 m and 29.1 m respectively. These stations were dominated by boulders and bedrock with abundant *E. esculentus, S. triqueter* and common encrusting sponges and bryozoans.

The circalittoral fine sand **SS.SSa.CFiSa** biotope complex was recorded at four stations (NH7, NH57, NH54, NH59) in the north-east of the survey area between 37.7 m - 71.3 m depth. This biotope was composed of mainly fine to medium sands. Epifauna were rare in their occurrence and consisted of *P. bernhardus, F. foliacea* and hydroid sp. as well as the sand eel *H. lanceolatus* and one spotted ray, *Raja montagui*.

A brittlestar bed was also recorded on epifaunally dominated bedrock **CR.MCR.EcCr.FaAlCr.Bri** at two stations (NH28, NH26); one at the northern and one at the southern end of the survey area at 28.3 m and 48.6 m respectively. Much like the **CR.MCR.EcCr.FaAlCr** biotope in our survey, the substrate was dominated by rock and mixed sediment with superabundant *O. fragilis*, *A. digitatum* (O-A), *E. esculentus* (C), and rare *P. bernhardus* and *A. rubens.*

The circallitoral muddy sand biotope complex **SS.SSa.CMuSa** was recorded at only one inshore station (NH58) to the north-west of the survey area at 29.7 m depth. Visible biota were extremely sparse from the video record (one *A. rubens*, one *Liocarcinus depurator*, and one flatfish).

Two other incidental records of PMF species were also made off Noss Head: a European eel (marine stage; *Anguilla anguilla*) at NH43, and a spiny dogfish (*Squalus acanthias*) at NH50 and NH13.

3.1.3 Grab sample analysis

Seven grab samples were collected as part of the Noss Head survey (Figure 19). A further five grabs were attempted but the hard substrate of the horse mussel bed probably prevented the jaws of the grab closing properly (see Appendix 8 for full details). Full infauna species data are available in Appendix 10.

Table 5. Descriptive and diversity statistics of sediment infauna grab samples, Noss Head.

Grab Sample	Species S	Abundance N	Species Richness D	Pielou's Evenness J	Shannon H'(loge)	Simpson 1-Lambda'
NHG3	82	477	13.13	0.7926	3.493	0.9373
NHG4	74	352	12.45	0.8288	3.567	0.9545
NHG6	107	633	16.43	0.8017	3.746	0.9485
NHG7	64	312	10.97	0.8147	3.388	0.9418
NHG8	102	673	15.51	0.7939	3.672	0.9524
NHG10	22	126	4.342	0.7612	2.353	0.8422
NHG11	141	1370	19.38	0.7418	3.671	0.9406

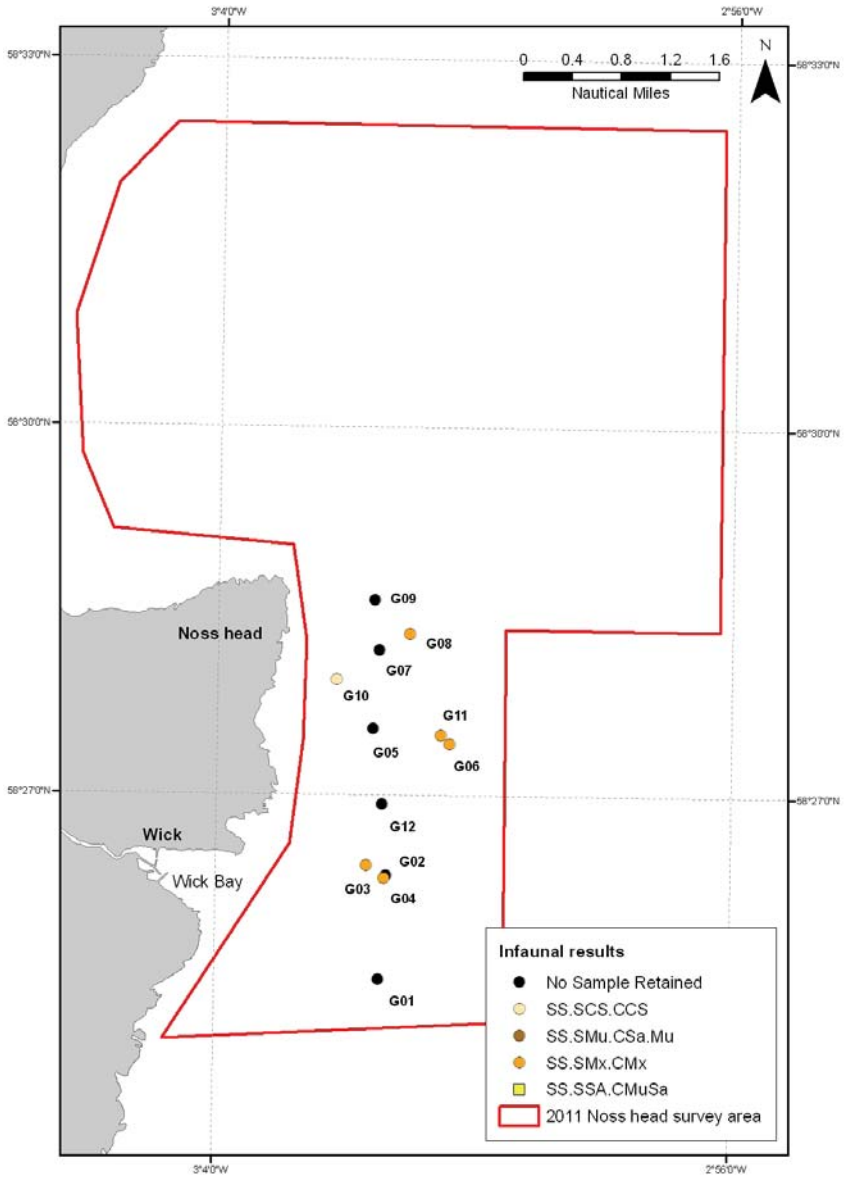
The station with the least number of infaunal species and individuals (NHG10; Table 5) was adjacent to the sparse DDV station NH15 (**SS.SCS.CCS**). At the other extreme, NHG11 contained more than six times the number of species (141). The most abundant species found at NHG11 were *Sphaerosyllis bulbosa* (201), Nematoda (188), *Goodallia triangularis* (138) and *Amphipholis squamata* (79). There where no clear spatial patterns between stations, with stations with the most and least number of species and abundances spatially interspersed.

PSA analysis from the grabs at Noss Head broadly matched the sediment records from video footage from the same locations. One grab (NHG07) contained a large proportion of hard material and a PSA sample was not possible but the fauna was nonetheless analysed. A full table of sediment analysis data is given in Appendix 12. Noss Head samples were dominated by gravel, very fine gravel and very coarse to coarse sand. PSA samples here do not represent the entire Noss Head area because they were restricted by the inability of the Day grab to penetrate hard packed shelly sediments (Table 6). It was apparent from video footage that large areas off Noss Head were dominated by dead shell and mixed rocky / cobbly sediments, particularly around the horse mussel bed area, however, grab sampling was not possible in these areas. The biotopes assigned to the grab stations reflect the nearest DDV station biotopes, confirming the biotope assignment process was satisfactory for both visual DDV assesment and infaunal species and substrate assessment.

Table 6. Summary of PSA from Noss Head grab samples.

Sieved Fraction (µm)	Wentworth ClassNee	NHG06	NHGO8	NHG10	NHG04	NHG03	NHG11
>4000	Gravel	12.1	34.9	0.3	16.1	7.8	4.2
2000 - 4000	Very fine gravel	18.5	20.6	6.2	29.2	18.2	14.6
1000 - 2000	Very coarse sand	25.1	19.1	45.2	25.9	41.5	30.6
500 - 1000	Coarse sand	24.4	13.6	45.4	13.8	26.2	34.2
250 - 500	Medium sand	16.0	6.7	1.9	8.9	2.9	13.0
125 - 250	Fine sand	1.4	1.9	0.4	1.8	0.5	1.2
63 - 125	Very fine sand	0.5	0.6	0.1	0.7	0.3	0.4
<63	Silt & Clay	2.0	2.6	0.5	3.5	2.6	1.7
MDØ (median diameter in phi)		-0.70	-1.80	-0.52	-1.32	-0.90	-0.50
MD (median diameter in mm)		1.62	3.48	1.43	2.50	1.87	1.41
QDØ (quartile deviation in phi)		1.15	N/A	0.49	0.95	0.62	0.73
QD (quartile deviation in mm)		0.45	N/A	0.71	0.52	0.65	0.60
Error in Sieving (%)		0.97	-2.50	0.23	0.95	0.28	-0.08
Folk substrate class		Gravelly sand	Gravelly sand	Very coarse sand	Gravelly sand	Gravelly sand	Gravelly sand

Figure 19. Biotope distribution from anlaysis of the infaunal samples



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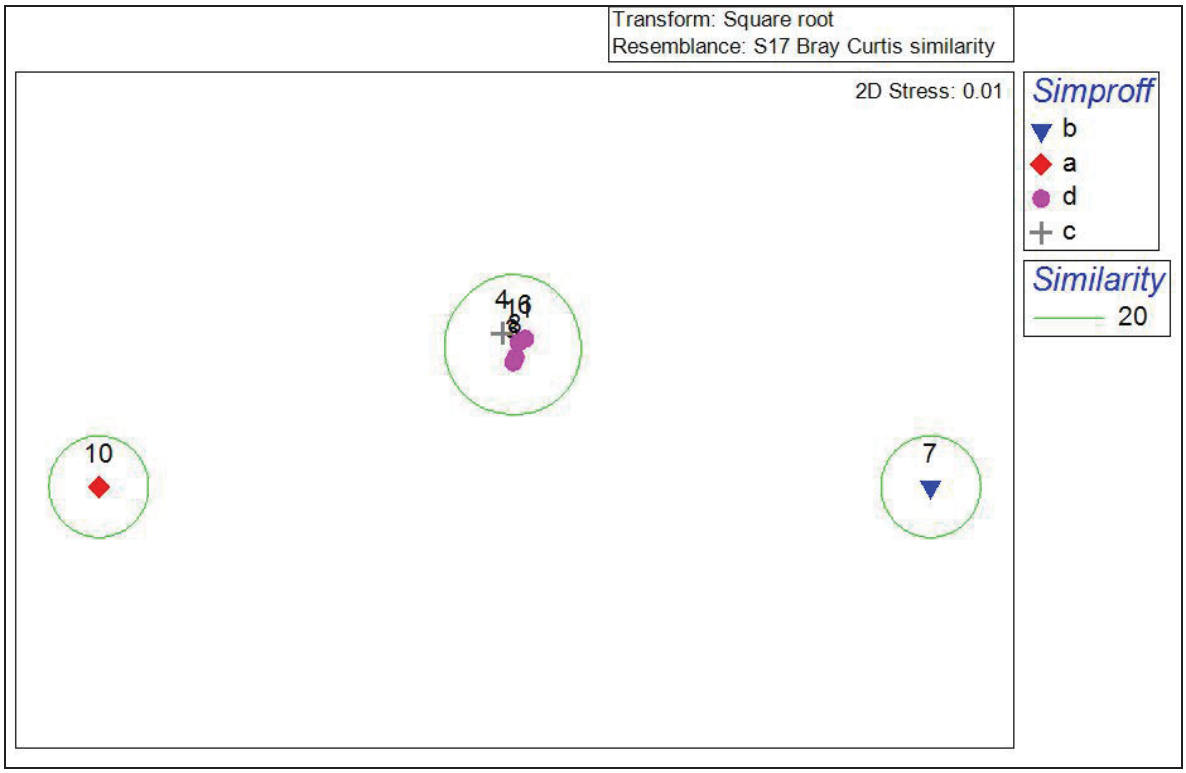
SIMPROF analysis using PRIMER v6 identified one group of stations and three stand - alone stations within the grab data (Figure 20). The single cluster of stations (d) consisted of four gravelly stations which had a similar community composition (stations 3, 6, 8, and 11). A subsequent SIMPER analysis showed that this group was driven by small differences in abundance of a large number of polychaetes, molluscs and echinoderms. This community occurred in circalittoral mixed sediment (**SS.SMx.CMx**) but bore little resemblance to the biotopes listed in this part of the national biotope classification (Connor *et al*., 2004), largely because five of the six biotopes in this part of the classification are described from epifauna records. Nevertheless, within the biotope complex **SS.SMx.CMx**, Connor *et al*. (2004) recognises that "a variety of communities can develop which are often diverse". Consequently our infaunal records are either an infaunal representation of the brittlestar bed biotope **SS.SMx.CMx.OphMx** and the *Flustra* and hydroid biotope **SS.SMx.CMx.FluHyd** OR mixed sediment biotopes that have yet to be described. Either way, the classification would appear to need development in this area and we are therefore unable to assert a biotope beyond the complex level (**SS.SMx.CMx**).

The other samples from the Noss Head area (stations NH7 and NH4) were also found in similar gravelly habitats but with differing abundances of many ubiquitous species. Station 10 was differentiated mainly because it contained very coarse sand with far fewer species. These grab samples can therefore be attributed to the circalittoral mixed sediment biotope complexes **SS.SMx.CMx** and **SS.SCS.CCS** (Table 6).

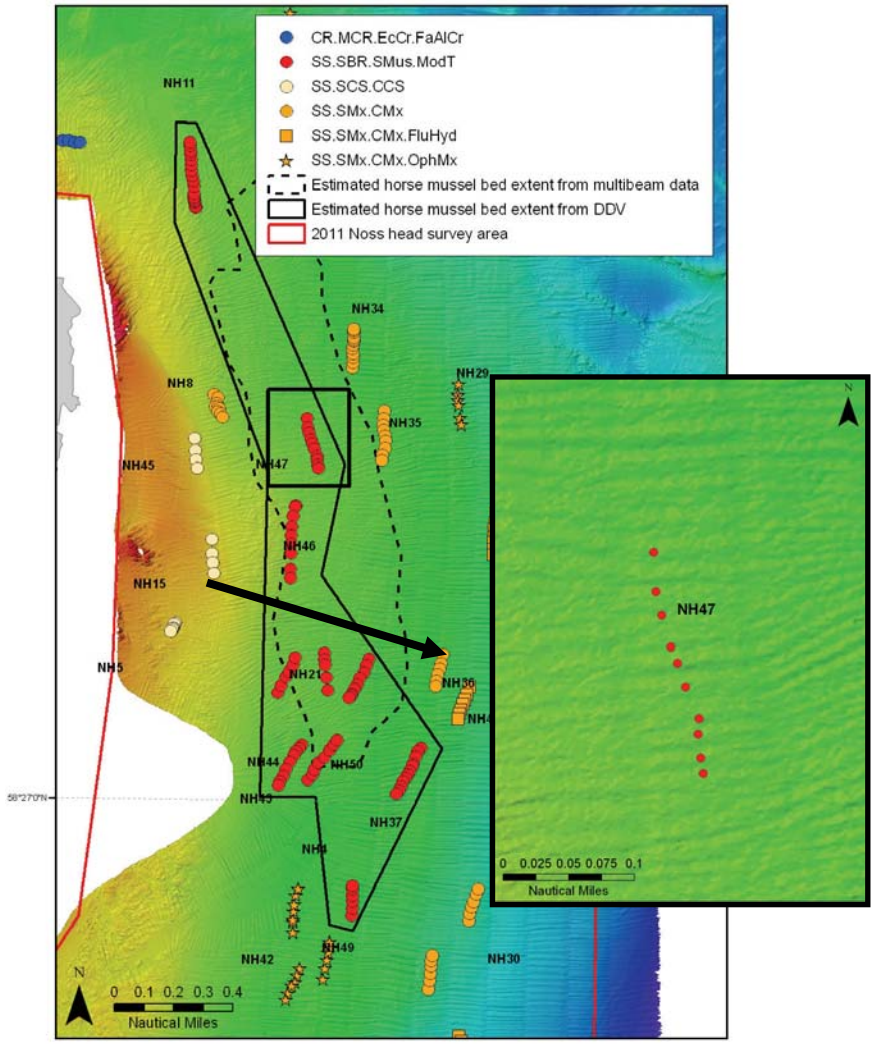
Figure 20. MDS plot of Noss Head grab data clustered into post hoc assigned groups a-d and labelled by grab number. Green circles illustrate the 20% similarity level



3.1.4 Multibeam data and extent estimates of the horse mussel bed

Our examination of multibeam data showed that it was possible to distinguish some of the same horse mussel bedforms reported by Lindenbaum *et al*. (2008) and Robinson *et al*. (2012) using 2 m resolution images from Noss Head. However, when DDV records of the horse mussel bed from video surveys were overlayed it was not possible to see the characteristic textural multibeam features in all instances. From the ground truthing of the bedform and experience of this bedform elsewhere (Lindenbaum *et al*., 2008; Robinson *et al*., 2012) it was possible to map these parts of the horse mussel bed with confidence. Interpolation between video tow areas where dense horse mussels had been recorded was also undertaken, irrespective of the multibeam data. Both these polygons were added together (Figure 21) to arrive at a conservative estimate for the bed of 3.85 km^2.

*Figure 21. Multibeam showing approximate horse mussel bed extents overlaid with horse mussel (*M. modiolus*) biotope records from DDVs (pink tracks). Insert shows detail of characteristic horse mussel bedform on multibeam*



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3.2 Southern Trench

3.2.1 General description

Drop down video tows were carried out at 74 sites in and around the Southern Trench between depths of 34 m and 214 m. A total of eight biotopes were recorded using DDV and grabs (Figure 22, Table 7). A field log of video tows can be seen in Appendix 3 with detailed descriptions of each transect in Appendix 5. A photographic inventory of each biotope recorded can be referenced in Appendix 6.

The most abundant biotope complex observed within the Southern Trench survey area was circalittoral fine mud (**SS.SMu.CFiMu**) found at 47 stations, with circalittoral mixed sediment (**S.SMx.CMx**) recorded at 19 stations (Figure 22). Stations with soft sediment biotope groups **SS.SMu.CFiMu, SS.SMu.CsaMu, SS.SCS** and **SS.SSa** were found throughout the central

strip of the Southern Trench. The rest of the survey area showed no distinct pattern of biotope types and was a mixture of hard substratum biotopes including **SS.SMx.CMx,** and **SS.SMx.CMx.FluHyd** on plateaus often near steep depth changes, and soft sediment biotopes in the deeper areas.

Table 7. Biotope classification descriptions from Southern Trench stations based on Connor et al. *(2004).*

Rock biotopes (IR = infralittoral rock; CR = circalittoral rock)		**Sublittoral Sediment biotopes** (SS)
High energy infralittoral rock (HIR)	High energy circalittoral rock (HCR)	Sublittoral coarse sediment (SCS)
Moderate energy infralittoral rock (MIR)	Moderate energy circalittoral rock (MCR)	Sublittoral sand (SSa)
Low energy infralittoral rock (LIR)	Low energy circalittoral rock (LCR)	Sublittoral mud (SMu)
Feature of infralittoral rock (FIR)	Feature of circalittoral rock (FCR)	Sublittoral mixed substrata (SMx)
		Sublittoral macrophytes on sediment (SMp)
Examples IR.HIR = Habitat complex (level 3 in classification) **IR.HIR.KFaR** = Biotope complex (level 4 in classification) IR.HIR.KFaR.**LhypR** = Biotope level (anything longer = sub-biotope)		Sublittoral biogenic reefs on seds (SBR)

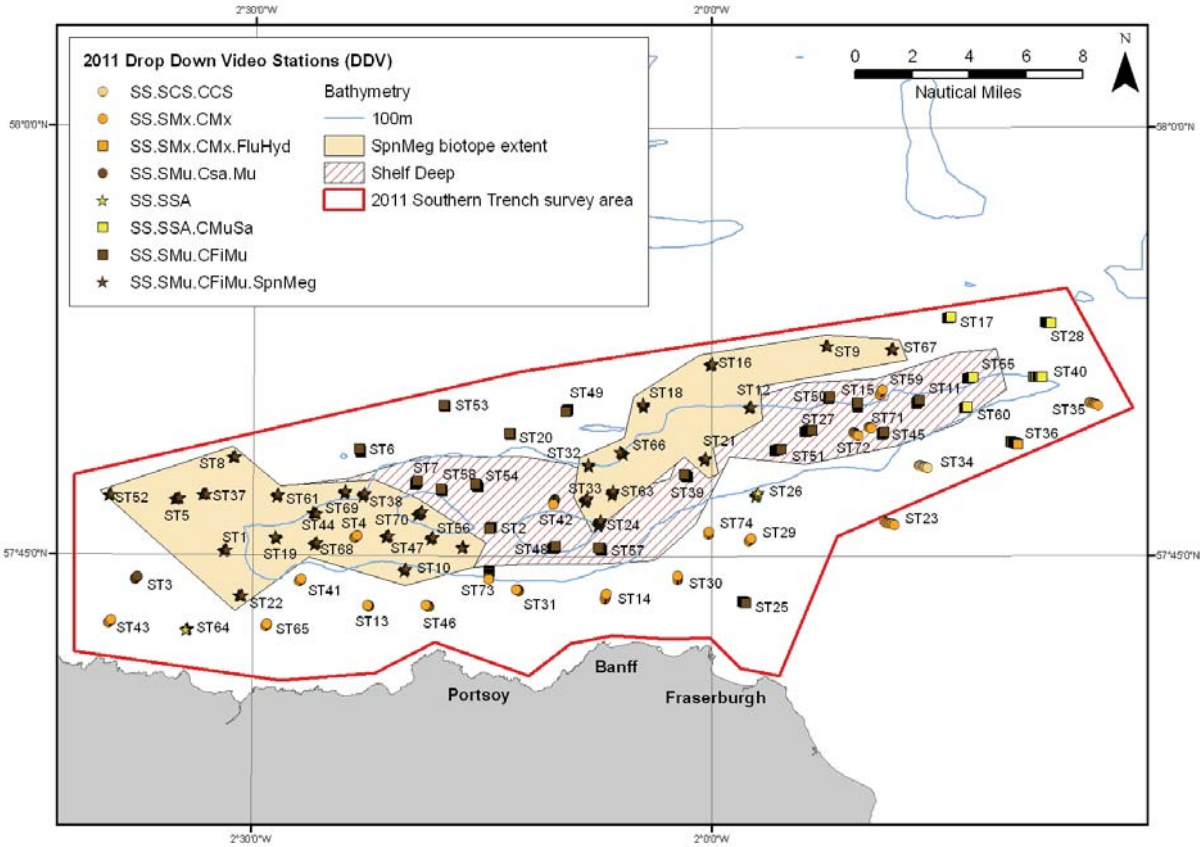
Biotope	Description	Count
SS.SCS.CCS	Circalittoral coarse sediment	1
SS.SSa.CMuSa	Circalittoral muddy sand	5
SS.SSa	Sublittoral sands and muddy sands	2
SS.SMx.CMx.FluHyd	Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment	1
SS.SMx.CMx	Circalittoral mixed sediment	18
SS.SMu.CFiMu.SpnMeg	Sea pens and burrowing megafauna in circalittoral fine mud	28
SS.SMu.CSaMu	Circalittoral sandy mud	1
SS.SMu.CFiMu	Circalittoral fine mud	19

3.2.2 PMFs / MPA search features observed

Burrowed mud with sea pens and megafauna (**SS.SMu.CFiMu.SpnMeg**) was identified at 28 stations between depths of 70 m and 188 m (Figure 22). These records were largely located within the large scale feature 'shelf deep' (Figure 22), with a decline in frequency of occurrence towards the eastern end of the trench where the seabed rose steeply to a mixed rocky plateau. Although the biotope was recorded widely, the abundance of the sea pen *Pennatula phosphorea* (Figure 23) was low, with an average of seven individuals per transect. However, two areas of sea pen distribution (**SS.SMu.CFiMu.SpnMeg**) were identified covering an area of approximately 50 km long and 10 km wide, with an estimated total size of 225.85 km^2 (Figure 22). Our records of this biotope contained the sea pen *Pennatula phosphorea,* but other species such as *Alcyonium digitatum*, *Munida* sp., *Urticina eques* and *Virgularia mirabilis* were also present. Crustacean burrows, including *Nephrops norvegicus* and *Goneplax rhomboides* were Common, but these species were rarely seen. The hydroid *Tubularia indivisa* was recorded as Rare at depths of 50 m – 100 m. This was attributed to drift specimens on small pebbles with greater numbers observed on the trench plateau. The most abundant species recorded were *Pennatula phosphorea, Munida* sp., *Goneplax* burrows and unidentifiable fish. The highest abundance (44 individuals) of *Pennatula phosphorea* was recorded at station ST37.

Due to the similar nature of the biotopes **SS.SMu.CFiMu.SpnMeg**, **SS.SMu.CFiMu** and **SS.SMu.Csa.Mu**, there was little difference in species composition and abundance visible from video records at these stations. Many **SS.SMu.CFiMu** stations were similar to **SS.SMu.CFiMu.SpnMeg** except that sea pens were present.

Figure 22. Biotope codes and approximate extent of SS.SMu.CFiMu.SpnMeg distribution in the Southern Trench



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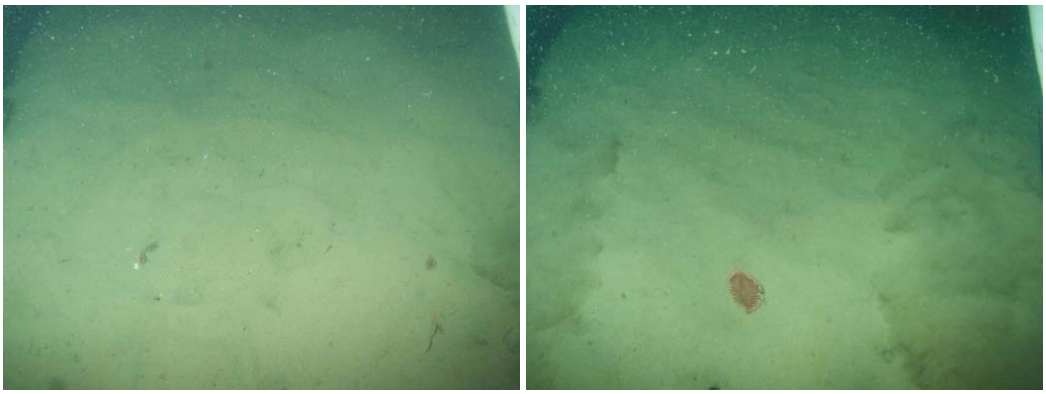
One other PMF was also observed within the Southern Trench: The white cluster anemone, *Parazoanthus anguicomus*, was Rare at 153 m – 178 m on a steep rock face at station ST33.

Figure 23. Photographs of SS.SMu.CFiMu.SpnMeg biotope found within the Southern Trench.



ST68 (CRW_4033) *ST9 (CRW_2191)*

3.2.3 Distirbution of other biotopes

In addition to the MPA search features and PMF biotopes already discussed other biotopes/ biotope complexes observed included **SS.SMx.CMx, SS.SMu.CsaMu**, **SS.SSa**, **SS.SMu.CFiMu**, **SS.SCS.CCS**, **SS.SMx.CMx.FluHyd** and **SS.SSA.CMuSa**.

The sublittoral fine mud biotope complex **SS.SMu.CFiMu** was recorded at 19 stations between 43 m - 214 m (Figure 22; Appendix 5). The **SS.SMu.CFiMu** stations were not attributed to either **SS.SMu.CFiMu.SpnMeg** or **SS.SMu.CFiMu.MegMax** as there was not enough evidence of key species normally associated with them such as *Maxmuelleria lankesteri* or sea pens. In addition some stations identified as **SS.SMu.CFiMu** were not heavily burrowed or contain large numbers of mounds, and identifying which species occupied those burrows was not possible from the grab samples.

The circallitoral mixed sediment biotope complex **SS.SMx.CMx** was recorded at 18 stations between 34 m - 192 m (Figure 22; Appendix 5). The centre of the trench within the shelf deep generally consisted of either circalittoral fine mud with sea pens and burrowing megafauna or circalittoral fine mud (**SS.SMu.CFiMu.SpnMeg, SS.SMu.CFiMu**). Towards the eastern end of the trench, however, circallitoral muddy sand (**SS.SSa.CMuSa**) biotopes were present. All of the biotopes recorded in the Southern Trench were estimated to have >70% mud and fine sand. Where sudden depth changes occurred within the trench, creating plateaus, circallitoral mixed sediment biotopes (**SS.SMx.CMx**) were recorded and in shallower depths between 54 m – 55 m an area of tide swept circallitoral mixed sediment with hydroids and bryozoans **SS.SMx.CMx.FluHyd** was observed.

The visible macrofauna of soft sediment biotopes / biotope complexes such as **SS.SMu.CFiMu.SpnMeg**, **SS.SMu.CsaMu** (62 m depth), **SS.SSa** (38 m and 77 m depth), **SS.SMu.CFiMu**, **SS.SCS.CCS** (82 m depth) and **SS.SSa.CMuSa** (72 m – 121 m depth) were dominated by burrowing species such as *Cerianthus lloydii*, *Chaetopterus* sp. (tubes), *Cirripedia* sp. and *N. norvegicus,* as well as abundant mobile species such as juvenile fish and rarely ray species including *Raja montagui, Raja clavata* and *Bathyraja brachyurops*. Also recorded were soft corals *Alcyonium digitatum* (R-C), *Urticina eques* (mostly C but locally S, with ~500 individuals in a DDV tow), *Pagurus bernhardus* (F), *A.rubens* (mostly C but locally S, with ~280 individuals), *Metridium senile* (R), as well as rare hydroid and bryozoan turfs.

Scattered throughout the area, patches of pebbles and drift material were observed at 17 stations supporting communities of the calcified worm *Salmacina dysteri* (R-O).

3.2.4 Grab sample analysis

Day grab samples were taken at 20 locations within the Southern Trench survey area (Figure 24, Appendix 10). Full species infauna data are given in Appendix 11, with a summary in Table 8.

Table 8. Descriptive and diversity statistics for infaunal data collected from Southern Trench grab samples.

Grab Sample	Species S	Abundance N	Species Richness D	Pielou's Evenness J	Shannon H'(loge)	Simpson 1-Lambda'
ST1	82	313	14.1	0.83	3.658	0.9499
ST2	48	169	9.162	0.7247	2.806	0.8388
ST3	36	86	7.857	0.8746	3.134	0.9379
ST4	42	141	8.285	0.8581	3.207	0.9451
ST5	23	62	5.331	0.8943	2.804	0.9313
ST6	49	163	9.423	0.807	3.141	0.9281
ST7	95	579	14.78	0.7128	3.246	0.8714
ST8	75	202	13.94	0.8817	3.807	0.966
ST9	46	101	9.751	0.931	3.564	0.9739
ST10	95	251	17.01	0.9183	4.182	0.9823
ST11	56	160	10.84	0.779	3.136	0.8754
ST12	46	85	10.13	0.9113	3.489	0.9647
ST13	79	286	13.79	0.8875	3.878	0.9728
ST14	27	68	6.162	0.8742	2.881	0.9276
ST15	65	250	11.59	0.7672	3.203	0.8883
ST16	35	110	7.233	0.8744	3.109	0.9435
ST17	70	217	12.83	0.8795	3.737	0.9681
ST18	36	90	7.778	0.8927	3.199	0.9496
ST19	55	236	9.883	0.7385	2.959	0.8759
ST20	66	202	12.25	0.8617	3.61	0.9595

The number of species per grab sample (Table 8) with the highest number of species found at ST7 and ST10 (95 species at each: **SS.SMu.CsaMu**). The lowest number of species (23) was at ST5 from the biotope **SS.SCS.CCS**, closely followed by ST14 (27) from the biotope **SS.SSa.CMuSa**. The same variety in abundance of individuals can be seen with a range from 62 individuals at ST5 to 579 at ST7, matching the stations with highest and lowest species numbers. No patterns were observed regarding species abundances or species counts, with the highest abundance at stations ST7 and ST10 along the central axis of the trench where ST14, a low species station was also found. Muddier **SS.SMu** stations had higher species and individual counts than sandier **SS.SSa** stations. The most abundant species were *Echinocardium cordatum, Astrorhiza limicola, Galathowenia oculata, Galathowenia oculata, Nereimyra punctata,* and *Prionosio banyulensis.*

SIMPROF analysis using PRIMER v6 showed a separation of stations into nine groups from the Southern Trench (Figures 24 and 25). Three clusters of muddy infaunal communities (e, h & f) occurred in the deeper and more gently shelving flanks of the Southern Trench. These communities were differentiated on subtle differences in the abundance of a large number of polychaetes and to a lesser extent, bivalves. Two of these communities were located in sandy mud sediments whilst the others were more often observed in areas of muddy sand. Station 10 differed slightly from the other sandy mud stations in its community composition, again, in terms of subtle abundances of a large number of species, but was nevertheless closely allied. All of these stations corresponded with records of

SS.SMu.CFiMu or **SS.SMu.CFiMu.SpnMeg** (Figure 24) with the exception of two records of a more mixed sediment (**CMx** biotope complex).

Stations around the periphery of the trench (58 m - 118 m) fell into two clusters and there were also some singletons. All of these were in sandier sediments (Table 9) and in the case of the stations STG01, STG02, STG04, STG09 cluster, a higher abundance of *Echinocardium cordatum* were recorded. The sediment composition of some of these peripheral stations also appeared to consist of greater quantities of mud, especially stations ST09, ST07, and ST020.

PSA analysis from the 20 grabs at the Southern Trench matched the sediment profiles estimated from video footage, and historic data provided by the BGS (2008 - 2009). A full table of sediment data is given in Appendix 11.

Figure 24. Biotopes assigned to grab sample stations in the Southern Trench study area

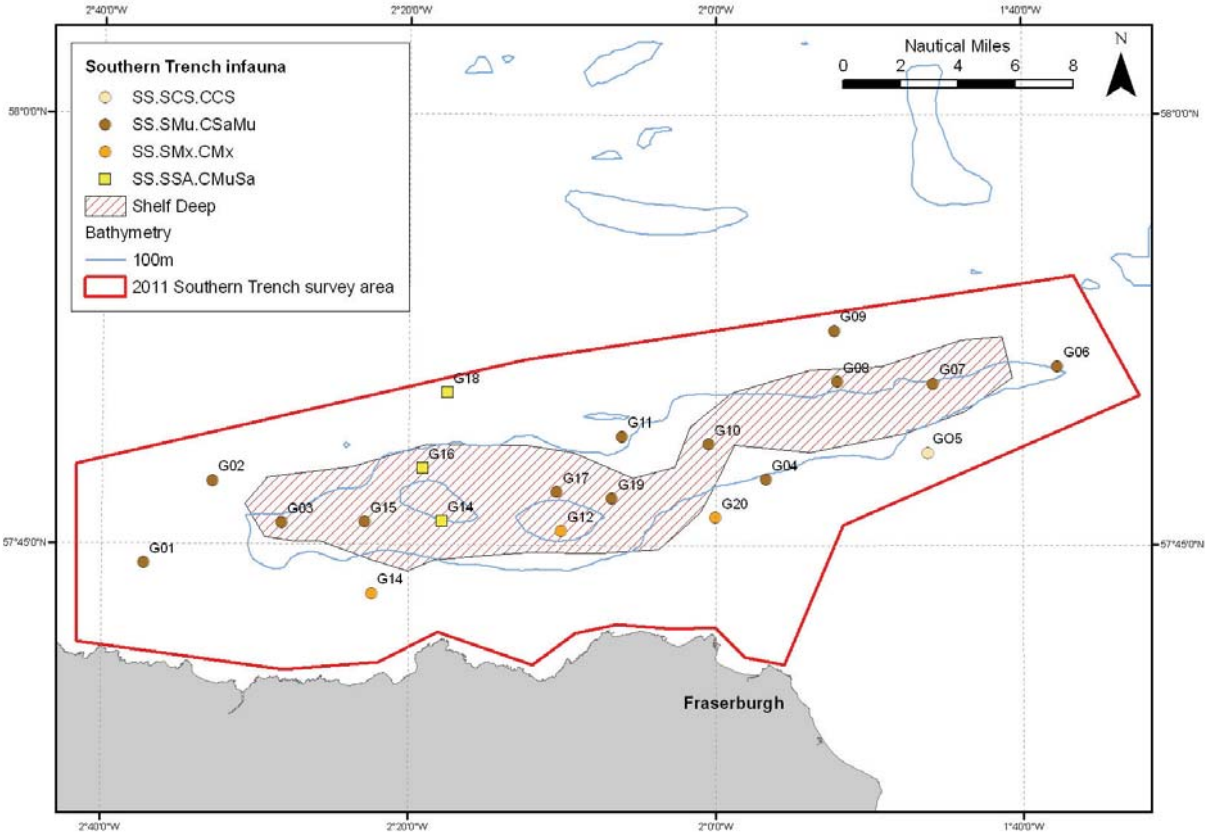


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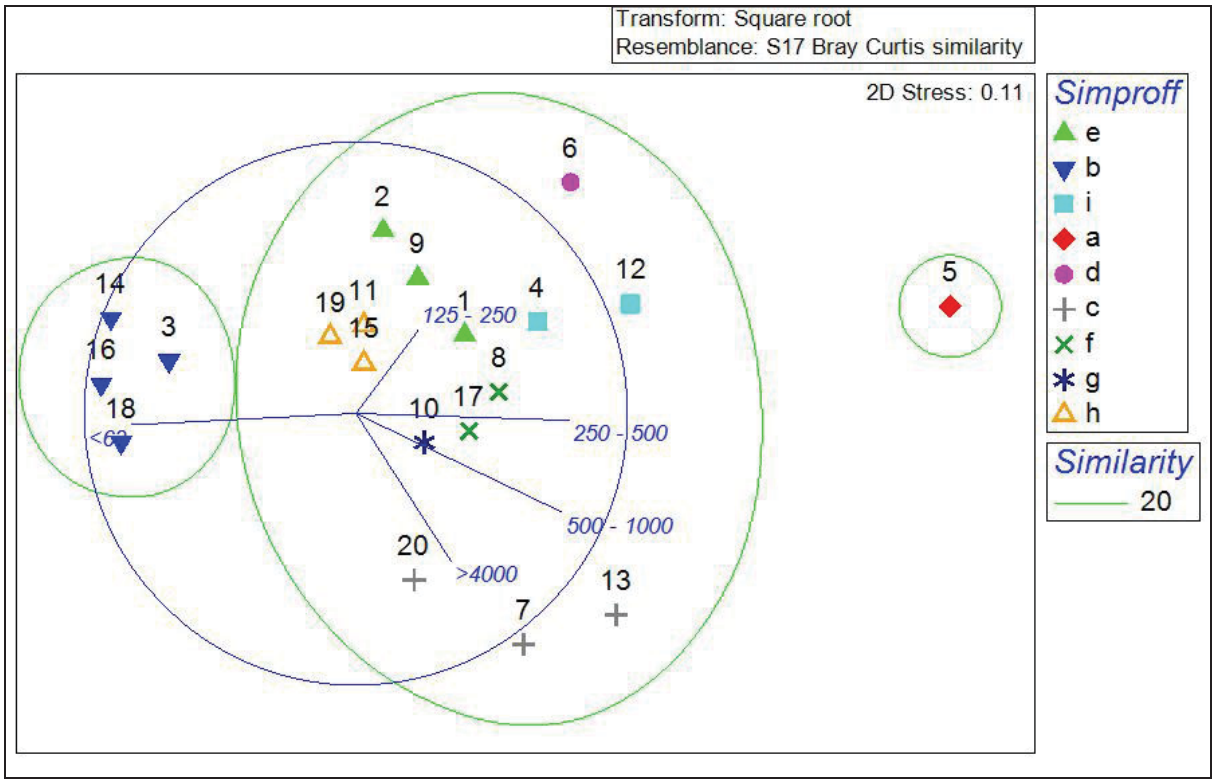
Table 9. PSA for Southern Trench grab samples

Sieved Fraction (µm)	Wentworth Class	STG 03	STG 18	STG 19	STG 02	STG 04	STG 09	STG 07	STG 05	STG 06	STG 08	STG 01	STG 11	STG 13	STG 17	STG 10	STG 20	STG 12	STG 14	STG 16	STG 15
>4000	Gravel	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.9	0.2	1.0	0.4	0.0	8.0	0.2	0.0	2.5	1.7	0.0	0.0	0.3
2000 - 4000	Very fine gravel	0.0	0.0	0.0	0.0	0.3	0.0	1.0	2.7	0.9	0.4	0.3	0.0	9.0	0.2	0.1	3.8	1.8	0.0	0.1	0.0
1000 - 2000	Very coarse sand	0.0	0.1	0.0	0.0	0.5	0.1	1.5	5.5	0.9	0.8	0.2	0.1	18.7	0.7	0.6	4.3	4.9	0.0	1.8	0.5
500 - 1000	Coarse sand	0.3	1.9	0.4	0.6	2.1	0.9	6.6	22	1.8	4.0	2.1	2.0	16.4	7.5	4.2	8.0	9.5	0.2	2.1	5.2
250 - 500	Medium sand	0.9	4.3	5.7	14.3	22.1	5.2	29.5	58.8	24.3	23.2	22.6	17.7	10	43	26.9	28.6	45.9	1.5	1.5	34.2
125 - 250	Fine sand	5.8	14.7	55.9	66.2	63.9	51.5	41.9	8.7	65.2	54.9	57.0	50.5	18.9	34.2	40.8	38.8	29.7	12.2	7.1	33.4
63 - 125	Very fine sand	51.4	33.6	24.7	9.6	6.4	33.2	10.3	0.2	2.0	10.2	12.7	17.2	8.0	3.9	12.7	9.0	2	45.5	31.1	8.9
<63	Silt & Clay	41.6	45.5	13.2	9.3	4.7	9.1	8.9	1.2	4.7	5.6	4.7	12.5	11.0	10.3	14.7	4.8	4.6	40.5	56.4	17.5
MDØ (median diameter in phi)		3.34	3.4	2.25	2.01	1.9	2.35	1.76	0.84	1.85	1.90	1.91	2.09	0.35	2.48	1.92	1.58	1.20	3.30	3.65	1.76
MD (median diameter in mm)		0.10	0.09	0.21	0.25	0.27	0.20	0.30	0.56	0.28	0.27	0.27	0.23	0.78	0.18	0.26	0.33	0.44	0.10	0.08	0.30
QDØ (quartile deviation in phi)		0.50	0.66	0.51	0.34	0.37	0.53	0.60	0.44	0.38	0.45	0.42	0.53	0.50	0.59	0.65	0.68	0.55	0.55	0.55	0.75
QD (quartile deviation in mm)		0.71	0.64	0.70	0.79	0.78	0.69	0.66	0.74	0.77	0.73	0.75	0.69	0.71	0.66	0.64	0.62	0.68	0.69	0.68	0.59
Error in Sieving (%)		0.12	0.72	-0.02	-0.11	0.36	0.01	0.35	4.40	0.10	0.69	0.39	-0.99	0.15	-0.28	-0.09	-0.49	-0.44	-0.22	0.38	0.46
Folk classification		Sandy Mud	Muddy Sand	Sandy Mud	Sandy Mud /Sand	Sand/ Sandy Mud	Sand/ Sandy Mud	Sand/ Sandy Mud	Sand	Sand/ Sandy Mud	Sand/ Sandy Mud	Sand/ Sandy Mud	Sandy Mud	Sandy Gravelly Mud	Sandy Mud	Sandy Mud	Sandy Mud /Sandy Gravelly Mud	Sandy Mud/Sandy Gravelly Mud	Muddy Sand	Muddy Sand	Sandy Mud

Figure 25. MDS plot of Southern Trench grab data clustered into post hoc assigned groups a-i and labelled by grab number. Blue lines show PSA fractions contributing to separation of stations. Green ellipses illustrate broad similarity at the 20% level



4. DISCUSSION

4.1 Noss Head horse mussel bed (SS.SBR.SMus.ModT)

Previous surveys in the Noss Head area (Triscom Marine, 2010 and MMT, 2010) enabled a 450 ha (4.5 km^2) estimated of the size of the horse mussel (*M. modiolus*) bed (MMT, 2010) to be made (Moore & Roberts, 2011). By interpolating superior quality video and superimposing an analysis of multibeam data, the present survey has confirmed the identity of the habitat and produced a more conservative estimate of 384.5 ha (3.85 km^2). This extent measure should be regarded cautiously because the multibeam data did not distinguish all areas of the horse mussel bed. In addition extensive areas to the north and north-east consisted of large amounts of dead shell (**SS.SMx.CMx**) which may have concealed further dense live horse mussels that have not been accounted for.

Prior to the present study, the largest known horse mussel bed in the UK was reported from off the Llyn Peninsula, North Wales, and was estimated to be 375 ha (Lindenbaum *et al*., 2008, Table 10). There are reports of a potentially larger bed off the Ards Peninsula in Northern Ireland (Edwards pers. comm. 2012) but work is currently underway to measure the size, health and species composition of the bed. The Noss Head bed is therefore the largest confirmed horse mussel bed in Scottish and UK waters, but, given the accuracy of measurement, it is probably better considered the largest in Scotland and one of the three largest in the UK.

Our drop down video records showed heterogeneity within the bed: with areas of high horse mussel density interspersed with expanses of shell material as seen off the Llyn Peninsula (Sanderson *et al*., 2008; Robinson *et al*., 2012). Our extent estimate therefore does not entirely include 100% horse mussel density but captures the heterogeneity within the overall bioherm. The processed multibeam data were unable to differentiate between bed areas of low relief and cannot therefore be relied on in isolation to obtain absolute boundaries as has been used off the Llyn Peninsula (Lindenbaum *et al*., 2008). Nevertheless, hydro acoustics may yet be able to distinguish areas of low relief by characteristics of the backscatter (see Lindenbaum *et al*., 2008) if this could be processed effectively.

Infauna samples collected in 2011 within the Noss Head survey area contained a total of 250 taxa. However, these taxa did not come from the horse mussel bed itself because the sampling gear available was unable to penetrate this habitat. Despite this, 75 taxa were recorded from DDV stations within the horse mussel bed. Table 10 shows comparative species numbers between horse mussel beds throughout the UK. If infaunal samples could be obtained from Noss Head it seems likely that the number of recorded species would increase particularly due to the tide-swept nature of the environment there. Many of the studies shown in Table 10 used divers to recover samples from the respective horse mussel beds, thus overcoming problems of grab penetration and meso-scale heterogeneity (see Lindenbaum *et al*., 2008; Rees *et al*., 2008). The available evidence strongly suggests that the Noss Head bed would be found to be a significant 'biodiversity hotspot' if a full biodiversity assessment is completed in future.

Table 10. Comparison of known UK horse mussel beds

Number of species	Type of coast	Bed (s)	Sampling method	Bed size	Author
278 total	Enclosed	Gutter Sound, Orkney	Diver clump samples (x4), video transect and diver MNCR	Unknown	Hirst *et al*. (2012)
270 total	Open	Point of Ayre, N. Isle of Man	Grab gear and video. Details unknown.	Unknown	Holt and Shalla, unpublished (in Holt *et al*., 1998)
268 total	Enclosed	Strangford Lough, N.I.	Diver samples (3 x 0.25m^2 cores), video and diver MNCR at 3 sites	0.5 km^2 remaining	Roberts *et al*. (2004)
230 total	Open	Pen Llyn, N. Wales	Diver suction samples (3 x 0.25m^2 cores)	3.75 km^2	Rees *et al*. (2008) Lindenbaum *et al*. (2008)
218 total	Enclosed	North Cava, Orkney	Diver clump samples (x4), video transect and diver MNCR	Unknown	Hirst *et al*. (2012)
211 total	Enclosed	Loch Alsh, N.W. Scotland	Diver clump samples (x4), video transect and diver MNCR	0.13 km^2	Mair *et al*. (2000)
136 total	Enclosed	Busta Voe, Shetland	Diver clump samples (x4), video transect and diver MNCR		Mair *et al*. (2000)
141 total	Enclosed	Loch Creran (upper basin), W. Scotland	Diver clump samples (x4), video transect and diver MNCR	0.02 km^2	Mair *et al*. (2000)

Number of species	Type of coast	Bed (s)	Sampling method	Bed size	Author
75 (video only)	Open	Noss Head, N.E. Scotland	Drop down video	3.84 km^2	Hirst *et al*. (this volume)
50	Enclosed	Annat Narrows (nr Corpach) W. Scotland	Diver clump samples (x4), video transect and diver MNCR	0.10 km^2	Moore *et al*. (2012)
44	Enclosed	Loch Leven (An Dunan) W. Scotland	Diver clump samples (x4), video transect and diver MNCR	0.01 km^2	Moore *et al*. (2012)
36 (video only)	Open	Copinsay, Orkney	Drop down video	0.42 km^2	Hirst *et al*. (2012)
35	Enclosed	Port Apin, W. Scotland	Diver clump samples (x4), video transect and diver MNCR	0.02 km^2	Moore *et al*. (2012)

4.2 Southern Trench - burrowed mud

Large-scale seabed incisions are a characteristic feature of the shelf seabed off east and north-east Scotland, and the Southern Trench is one of the largest (Brooks *et al*., 2011). In the present survey the PMF / MPA search feature **S.SMu.CFiMu.SpnMeg** (a component of the broad habitat burrowed mud) was observed regularly throughout the Southern Trench survey area (28 stations). Two distinct areas of this biotope were contained within an area approximately 50 km long and 10 km wide, with an estimated total size of 225.85 km^2 (90.25 km^2 and 135.6 km^2). This biotope was observed both inside and outside of the shelf deep large scale feature with numbers of sea pens, which help to characterise the biotope, low (1 - 44 individuals). Greathead *et al.* (2007) found "Frequent" and "Common" *P. phosphorea* in the Moray Firth as well as records of *V. mirabilis*, which was completely absent from the present survey. Records from the *Nephrops* stock assessment video in 2008 – 2010, were largely located outside of the trench with only a few historic records within the Southern Trench prior to 2011. It is therefore not possible to determine if the **SS.SMu.CFiMu.SpnMeg** biotope has changed in recent years from historic data. *P. phosphorea* is known to retract into the sediment when disturbed however due to the similarities of the DDV system used in 2011 with the system used by Greathead *et al.* (2007) it is unlikely that the low abundance estimates were caused by the video sled.

The fine mud biotope complex **SS.SMu.CFiMu** was recorded at a number of stations during the survey when there was no evidence of other burrowing organisms such as *Maximuelleria lankesteri* on video or within the infauna samples. Nevertheless, a number of the stations assigned to the biotope complex **SS.SMu.CFiMu** resembled the **SS.SMu.CFiMu.SpnMeg** biotope but with the absence of any sea pen species. It is likely that greater grab sampling intensity would have allowed greater resolution of this biotope complex (**SS.SMu.CFiMu**) however this was not within the time constraints of the current survey. Nevertheless, our video footage does suggest the presence of large burrowing organisms such as *Goneplax rhomboides*, *Nephrops norvegicus* and callianassid shrimps in some parts of the trench.

4.3 Human activities observed

No clear signs of human impact such as trawl marks were observed during the Southern Trench survey, however, the low numbers of *Pennatula phosphorea* suggests they may have declined.

The most direct threat to **SS.SMu.CFiMu.SpnMeg** is from demersal fishing gear and there is good evidence that this biotope is threatened by trawling elsewhere (OSPAR, 2010). The intensity of *Nephrops* fisheries and their wide geographic coverage mean they have the potential to affect large areas of sea pens and burrowing megafauna (Hughes, 1998). The Southern Trench is known to be fished for *Nephrops*. High abundances of unidentified juvenile fish were recorded within the Southern Trench in the present study, and commercial fish such as whiting and pouting were also recorded: indicating that the area may also have some importance for fin fisheries.

During the fieldwork creel boats were present throughout the Southern Trench survey area. The presence of multiple creels, connected to each other via strings could potentially, leave drag scars on the seabed, or 'cheese-wire' sea pen communities (**SpnMeg**) when hauled. Although this potential impact is recognised elsewhere (Hughes *et al*., (1998) there is also evidence of resilience to this kind of activity (Kinnear *et al*., 1996).

Within the central part of the Noss Head horse mussel bed, areas of exposed mud were observed, clear of any shell material (NH44). This may be as a direct result of recent fishing activity: possibly benthic trawl scars, or more likely, creel drag scars as NH44 was close to numerous creel buoys. Damage to horse mussel beds and their associated epifauna by demersal fishing gear has been inferred in Strangford Lough and implicated in loss of horse mussel beds off the south-east of the Isle of Man (Holt *et al*., 1998; Magorrian & Service, 1998; Strain *et al*., 2012). The sensitivity of horse mussel beds to static gears is not known to be high but some epifauna, and the bed structures themselves may be of medium sensitivity under high fishing intensity (e.g. Holt, 1998; JNCC & Natural England, 2011).

4.4 Geological features

The Southern Trench is an exceptional example of an enclosed (glacial) seabed basin. The morphology of the trench is irregular and forms the most topographically complex region of the Moray Firth (Brooks *et al*., 2011). The shelf deep was observed to largely consist of muddy sediments ranging from sandy mud to fully burrowed mud habitats in the central band of the trench. At the edge of the basin, where steep depth changes occur, the habitat changes to mixed substrate with boulders cobbles and pebbles with patches of softer sandier substrate where the depth plateaued around the trench periphery.

Noss Head, however, showed no geological features of importance other than the formation of the extensive horse mussel bed. Multibeam data collected for this survey around the Noss Head area highlighted variable seabed types in the north and north-east, compared to the remainder of the survey area. Waves could be clearly distinguished on the multibeam images with DDV confirming these as sand waves. There were no other features of geological interest highlighted by the multibeam images or discovered during current survey.

4.5 Further work

4.5.1 Noss Head

There is scope for further identification and more accurate mapping of the horse mussel bed off Noss Head by re-processing the raw backscatter high resolution multibeam data (as seen in Lindenbaum *et al*., 2008) using different software. It would also be beneficial to better understand the health status and better evaluate the biodiversity of the Noss Head horse mussel bed. Tidal conditions and depth of the site make diver collected clump samples challenging, but not impossible with careful preparation. The alternative is to employ aggressive grab sample gear such as a Hammond or Kingston grab because conventional Day and Van Veen Grabs are known to be unsuccessful on this type of seabed.

4.5.2 Southern Trench

A further extension to the work carried out in the Southern Trench, with greater sampling intensity, could be carried out to investigate further multibeam features such as steep rock slopes and drop offs which may support a wider community of recorded PMF search features such as *Parazoanthus anguicomus*. If other PMF / MPA search features are confirmed it could aid in MPA assessment for the area.

5. REFERENCES

Aquatera and Triscom. 2010. *Appendix 3-A ROV Survey of Potential Subsea Cable Route and Offshore Hub Location in the Moray Firth*.

Bradwell, T., Stoker, M.S., Golledge, N.R., Wilson, C.K., Merritt, J.W., Long. D., Everest, J., Hestvik, O.B., Stevenson, A.G., Hubbard, A.L., Finlayson, A.G. & Mathers, H.E. 2008. The Northern sector of the last British Ice Sheet: maximum extent and demise. *Earth-Science Reviews*, **88**, 207–226.

Brooks, A.J., Kenyon, N.H., Leslie, A., Long, D. & Gordon, J.E. 2011. Characterising Scotland's marine environment to define search locations for new Marine Protected Areas. Part 2: The identification of key geodiversity areas in Scottish waters (interim report July 2011). *Scottish Natural Heritage Commissioned Report No.430* (Project no. 28877).

Clarke, K.R. & Warwick, R.M. 2001. *Change in marine communities: an approach to statistical analysis and interpretation.* 2nd ed. PRIMER-E, Plymouth.

Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. & Reker, J.B. 2004. The National Marine Habitat Classification for Britain and Ireland. Version 04.05. Peterborough: Joint Nature Conservation Committee. ISBN: 1 861 07561 8 (internet version).

Greathead, C.F., Donnan, D.W., Mair, J.M. & Saunders, G.R. 2007. The sea pens *Virgularia mirabilis*, *Pennatula phosphorea* and *Funiculina quadrangularis*: distribution and conservation issues in Scottish waters. *Journal of. Marine Biology Association of the United Kingdom*, **87**, 1095–1103.

Hirst, N.E., Cook, R.L., James, B., Kent, F.E.A., Loxton, J.L., Porter, J.S. & Sanderson, W.G. 2012. The distribution of Priority Marine Features and MPA search features in Orkney waters: Rousay to Copinsay including Eday Sound and points in Scapa Flow. *Scottish Natural Heritage Commissioned Report No. 509*.

Hiscock, K. 1996. Marine Nature Conservation Review: rationale and methods. Peterborough: Joint Nature Conservation Committee. [Coasts and seas of the United Kingdom. MNCR series.].

Holmes, R., Bulat, J., Henni, P., Holt, J., James, C., Kenyon, N., Leslie, A., Long, D., Musson, R., Pearson, S. & Stewart, H. 2004. DTI Strategic Environmental Assessment Area 5 (SEA5): Seabed and superficial geology and processes. *British Geological Survey Report CR/04/064N*.

Holt, T.J., Rees, E.I.S., Hawkins S.J. and Seed, R. 1998. Biogenic reefs, An overview of dynamic and sensitive characteristics for conservation managent of marine SACs. *UK marine SACs Project for* SNH, DOE (NI), CCW, EN, JNCC & SAMS, IX, pp. 170.

Hughes, D.J. 1998. Sea pens and burrowing mega fauna (volume III). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project), pp. 105.

JNCC & Natural England. 28 April 2011. Advice from the Joint Nature Conservation Committee and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features. FINAL VERSION

Kaiser, M.J., Clarke, K.R., Hinz, H., Austen, M.C.V., Somerfield, P.J. & Karakassis, I. 2006. Global analysis and prediction of the response of benthic biota and habitats to fishing. *Marine Ecology Progress Series*, **311**, 1-14.

Kinnear, J.A.M., Barkel, P.J., Mojseiwicz, W.R., Chapman, C.J., Holbrow, A.J., Barnes, C. & Greathead, C.F.F. 1996. Effects of *Nephrops* creels on the environment. *Fisheries Research Services Report No. 2/96.*

Lindenbaum, C., Bennell, J.D., Rees, E.I.S., McClean, D., Cook, W., Wheeler, A.J. & Sanderson, W.G. 2008. Small-scale variation within a *Modiolus modiolus* (Mollusca: Bivalvia) reef in the Irish Sea: I. Seabed mapping and reef morphology. *Journal of the Marine Biological Association of the United Kingdom*, **88***,* 133-141.

Long, D. & Stoker, M. 1986. Valley asymmetry: Evidence for periglacial activity in the Central North Sea. *Earth Surface Processes and Landforms*, **11**, 525 – 532.

Magorrian, B.H. & Service, M. 1998. Analysis of underwater visual data to identify the impact of physical disturbance on horse mussel (*Modiolus modiolus*) beds. *Marine Pollution Bulletin*, **36**(5), 354-359.

Mair, J.M., Moore, C.G., Kingston P.F. & Harries, D.B. 2000. A review of the status, ecology and conservation of horse mussel Modiolus modiolus beds in Scotland. *Scottish Natural Heritage Commissioned Report no. F99PA08*, pp. 89.

Marine Scotland. 2011a. A Strategy for Marine Nature Conservation in Scotland's Seas http://www.scotland.gov.uk/Topics/marine/marine-environment/Conservationstrategy/marineconstrategy/

Marine Scotland. 2011b. Marine Protected Areas in the Seas around Scotland. Guidelines on the selection of MPAs and development of the MPA network. Available from <http://www.scotland.gov.uk/marinescotland/mpaguidelines>

Marine Scotland Science. http://www.scotland.gov.uk/Topics/marine/marine-environment/species/fish/shellfish/nephrops, accessed on 29 March 2012.

Mason, C. 2011. Best Practice Guidance: Particle Size Analysis (PSA) for Supporting Biological Analysis. The National Marine Biological Analytical Quality Control Scheme (NMBAQC).

MMT. 2010. *Marine Survey Report: Project Shetland HVDC Cable Link - HUB - Geophysical Survey*. Report by MMT for Scottish and Southern Energy, MMT Project number 100711, November 2010.

Moore, C.G. & Roberts, J. M. 2011. An assessment of the conservation importance of species and habitats identified during a series of recent research cruises around Scotland*. Scottish Natural Heritage Commissioned Report No. 446.*

Moore, C. G., Harries, D. B. & Trigg, C. 2012. The distribution of selected MPA search features within Lochs Linnhe, Etive, Leven and Eil: a broadscale validation survey*. Scottish Natural Heritage Commissioned Report No. 502*.

OSPAR. 2010. Quality Status Report 2010. *Case Reports for the OSPAR List of threatened and/or declining species and habitats – Update.* http://qsr2010.ospar.org/media/assessments/p00358_case_reports_species_and_habitats_2008.pdf

Rees, E.I.S. 2009. Background document for *Modiolus modiolus* beds. Biodiversity Series, OSPAR Commission. pp. 28.

Rees, E.I.S., Sanderson, W.G., Mackie, A.S.Y. & Holt, R.H.F. 2008. Small-scale variation within a *Modiolus modiolus* (Mollusca: Bivalvia) reef in the Irish Sea. III. Crevice, sediment infauna and epifauna from targeted cores. *Journal of the Marine Biological Association of the United Kingdom*, **88**(1), 151-156.

Roberts, D., Davies, C., Mitchell, A., Moore, H., Picton, B., Portig, A., Preston, J., Service, M., Smyth, D., Strong, D. & Vize, S. 2004. Strangford Lough Ecological Change Investigation (SLECI). Report to Environment and Heritage Service by the Queen's University, Belfast.

Robinson, K.P. & Tetley, M.J. 2007. Behavioural observations of foraging minke whales (*Balaenoptera acutorostrata*) in the outer Moray Firth, north-east Scotland. *Journal of the Marine Biological Association of the United Kingdom.* Vol 87. Issue 1, pp. 85-86.

Robinson, K.P., Tetley, M.J. & Mitchelson-Jacob, E.G. 2009. The distribution and habitat preference of coastally occurring minke whales (*Balaenoptera acutorostrata*) in the outer southern Moray Firth, northeast Scotland*. Journal of Coastal Conservation*. Vol 13, No1. pp. 39-48.

Robinson, K.A., Mackie, A.S.Y., Lindenbaum, C., Darbyshire, T., Van Landeghem, K.J.J. & Sanderson, W.G. 2012. Seabed Habitats of the Southern Irish Sea. Seafloor Geomorphology as Benthic Habitat. Elsevier.

Rumohr, H. 1990. *Soft Bottom Macrofauna: Collection and Treatment of Samples.* Techniques in Marine Environmental Sciences No.8. ICES, pp. 18.

Sanderson, W.G., Holt, R., Kay, I., Ramsay, K., Perrins, J., Mcmath, A.J. & Rees, E.I.S. 2008. Small-scale variation within a *Modiolus modiolus* (Mollusca: Bivalvia) reef in the Irish Sea. II. Epifauna recorded by divers and cameras *Journal of the Marine Biological Association of the United Kingdom,* 88(1), pp. 143–149.

SNH. 2011. Priority Marine Features. <http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/priority-marine-features/>, accessed on 03 January 2012.

Strain, E.M.A., Allcock, A.L., Goodwin, C.E., Maggs, C.A., Picton, B.E.& Roberts, D. 2012. The long-term impacts of fisheries on epifaunal assemblage function and structure, in a Special Area of Conservation. *Journal of Sea Research,* **67**, 58–68.

Tetley, M. 2010. *The Distribution, Ecological Niche Modelling and Habitat Suitability Mapping of the Minke Whale within the North Atlantic*. Chapter IV. The habitat suitability mapping of *Balaenoptera acutorostrata* within the contiguous North Atlantic: applications for future marine spatial planning and management strategies. Bangor University Thesis.

Triscom Marine. 2010. Horse mussel bed investigation off Noss Head, Oct 21-22 2010. Report TT1015. Appendix 5A. Unpublished report to Aquatera Ltd, Orkney.

Woods-Ballard, A., Parsons, E.C.M., Hughes, A.J., Velander, K.A., Ladle, R.J. & Warburton, C.A. 2003. The sustainability of whale-watching in Scotland. *Journal of Sustainable Tourism* **11 (1)**, 40-55.

Appendix 1. Drop down video data entry sheet

Date	Location	Station	Start Time	Start Coordinates	Dominant Substrate Type	Taxa	End Time	End Coordinates	Depth - start & end (m)	Comments

Appendix 2. Noss Head Drop down video field log. - Details of taxa observed can be seen in Appendix 4

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
03/09/11	Noss Head	NH27	1	07:30	07:35	58.29.587N 003.1.558W	58.29.738N 003.1.600W	50	50	Large Boulders, brittlestar beds	Boulders large, too rough too continue so dive aborted. Dense brittlestar dominated. 6 photos
03/09/11	Noss Head	NH11	1	07:57.6	08.10.44	58.29.001N 003.2.167W	58.29.232N 003.2.212W	37	37.98	Small Boulders, with shell/gravel	29 photos, good transect, mixed shell and gravel with empty mussel shells
03/09/11	Noss Head	NH14	1	08.26.38	08:33	58.29.328N 003.0.995W	58.29.520N 003.0.981W	48.66	49.38	Dense Brittlestar bed with small cobbles	7 photos, good transect dominated by brittlestar bed
03/09/11	Noss Head	NH34	1	08:54.4	09:04.2	58.28.464N 003.1.144W	58.28.608N 003.1.135W	41.94	43.8	Shell/Gravel, empty shells	12 Photos, good transect, shell/gravel, lots of empty shells
03/09/11	Noss Head	NH8	1	09:20.5	09:29.3	58.28.372N 003.2.031W	58.28.299N 003.1.975W	34.36	38.1.975	Shell/Gravel, empty shells	9 Photos, good transect, increase in shell density towards end of transect.
03/09/11	Noss Head	NH47	1	10:11.2	10:18.6	58.28.300N 003.1.433W	58.28.122N 003.1.353W	39.25	38.96	Mussel bed, empty shells	10 Photos, dense brittlestars in middle of transect, *Modiolus*

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
03/09/11	Noss Head	NH21	2	11:07.3	11:11.5	58.27.529N 003.1.298W	58.27.357N 003.1.278W	39.37	40.4	Mussel bed, empty shells	5 Photos, Tow too fast towards end.
03/09/11	Noss Head	NH5	2	11:24.5	11:29.6	58.27.601N 003.2.263W	58.27.568N 003.2.292W	27.17	27.54	Sand	Sand waves with scattered shells and empty shells, 6 photos.
03/09/11	Noss Head	NH15	2	11:41.4	11:45.3	58.27.882N 003.2.033W	58.27.478N 003.2.010W	28.24	27.5	Sand	Sand waves, 4 photos
03/09/11	Noss Head	NH46	2	12:03.4	12:12.0	58.28.010N 003.1.492W	58.27.744N 003.1.524W	38.11	38.94	*Modiolus* bed, gravel/sand	Patches of gravel/shell between expanses of *Modiolus*. Big change at 12:08. Quite dense areas of *Modiolus*. 9 photos
03/09/11	Noss Head	NH45	2	12:30.3	12:34.2	58.28.228N 003.2.156W	58.28.103N 003.2.124W	29.69	32.5	Sand, gravelly sand	Nothing but sand waves, bit of algae, 4 photos
03/09/11	Noss Head	NH29	2	12:52.3	12:59.2	58.28.421N 003.0.455W	58.28.266N 003.0.432W	48.71	48.4	Small boulders, covered in brittlestars	7 Photos, Boulders to gravel back to boulders, dominant brittlestars. Change from boulders to gravel at 12:58
03/09/11	Noss Head	NH6	2	13:10.3	13:17.1	58.28.996N 003.0.190W	58.27.831N 003.0.215W	49.25	49.4	Gravelly sand, cobbles, small boulders.	7 Photos, few switches of dominant substrate
03/09/11	Noss Head	NH35	2	13:31.4	13:40.1	58.28.332N 003.0.930W	58.28.150N 003.0.948W	43.57	43.57	Gravelly sand, Boulders, shell	9 photos, lots of empty shell

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
03/09/11	Noss Head	NH36	3	13:54.5	14:01.2	58.27.508N 003.0.529W	58.27.374N 003.0.582W	47.07	46.85	Gravel and empty shells	Lots of empty shells. 6 Photos, patches of poss. live *Modiolus*
03/09/11	Noss Head	NH48	3	14:12.3	14:19.2	58.27.395N 003.0.358W	58.27.277N 003.0.434W	48.72	48.44	Shell/Gravel, empty shells	Shell/Gravel, lots of empty shells, possibly scattered live *Modiolus*. 7 photos
03/09/11	Noss Head	NH37	3	14:25.4	14:37.4	58.27.198N 003.0.654W	58.27.021N 003.0.823W	46.54	47.05	Gravelly, Shell, clumps of modiolus	Clumps of live *Modiolus*, more dense at 14:34. 12 photos
03/09/11	Noss Head	NH50	3	14:49.0	14:56.6	58.27.485N 003.1.008W	58.27.347N 003.1.139W	42.9	41.86	*Modiolus* bed, gravel/sand	Lots of *Asterias* on dense areas of mussels. Lots of brittlestars. 9 photos
03/09/11	Noss Head	NH43	3	15:04.3	15:12.5	58.27.193N 003.1.432W	58.27.047N 003.1.588W	41.93	42.22	*Modiolus* bed, gravel/sand	Became gravelly with more empty shells at 15:10. More empty shells and rubble at 15:12
03/09/11	Noss Head	NH4	3	15:56.5	16:04.3	58.27.068N 003.1.389W	58.27.221N 003.1.176W	42.45	42.45	Modiolus with sand and gravel patches	Patchy leading to denser *Modiolus* with lots of dead shells. 8 photos
03/09/11	Noss Head	NH44	4	16:14.3	16:20.2	58.27.366N 003.1.590W	58.27.498N 003.1.478W	40.01	39.88	Gravelly shell and *Modiolus*	*Modiolus* increasingly dense after 16:17. Gravel patch at 16:18 then back to *Modiolus* - dredge?

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth	Dominant Substrate	Comments
03/09/11	Noss Head	NH42	4	16:37.2	16:43.4	58.26.555N 003.1.271W	58.26.725N 003.1.422W	43.51	44.88	Brittlestar bed on gravelly shell	Possible live scattered *Modiolus*, lots of empty shells. Fast tow. 7 photos
03/09/11	Noss Head	NH1	4	16:56.2	17:01.1	58.26.398N 003.1.271W	58.26.532N 003.1.233W	43.55	43.57	Gravelly shell with boulders	Possible scattered live *Modiolus*. Boulders at end of transect. Fast tow. 6 photos
03/09/11	Noss Head	NH49	4	17:12.5	17:18.3	58.26.610N 003.1.095W	58.26.728N 003.1.094W	46.23	45.55	Gravelly shell, empty shells	*Modiolus* clumps, lots of empty shells and brittlestars. 6 photos
03/09/11	Noss Head	NH33	4	17:31.3	17:36.5	58.26.361N 003.0.595W	58.26.484N 003.0.571W	49.73	49.88	Sand and cobbles to small boulders	Small boulders at 17:33. No *Modiolus*. 6 photos
03/09/11	Noss Head	NH30	4	17:45.1	17:50.4	58.26.596N 003.0.342W	58.26.720N 003.0.277W	52.14	52.14	Cobbles and gravelly sand	Occasional bigger boulders.
04/09/11	Noss Head	NH 13	5	07:08.1	07:14,29	58.29.414N 003.5.610W	58.29.406N 003.5.469W	22.86	24.82	Rocky reef, boulders	Change to sand and large boulders at 07:12. 7 photos
04/09/11	Noss Head	NH7	5	07:29.4	07:34.2	58.30.177N 003.4.307W	58.30.187N 003.4.192W	33	33.48	Sand	Sand, nothing else. 5 Photos
04/09/11	Noss Head	NH10	5	07:44.6	07:50.4	58.30.333N 003.3.196W	58.30.457N 003.3.117W	41.54	43.05	Gravelly sand and scattered boulders	Brittlestars dominated but not dense. 6 photos.

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04/09/11	Noss Head	NH28	5	08:10.6	08:15.5	58.32.232N 003.4.621W	58.32.389N 003.4.559W	24.07	23.56	Sand and bedrock	Bedrock densely ed with brittlestars. 5 Photos
04/09/11	Noss Head	NH23	5	08:33.5	08:37.0	58.31.458N 003.3.119W	58.31.561N 003.3.138W	47.88	50.37	Boulders	Video stops twice before being aborted. 3 photos.
04/09/11	Noss Head	NH3	5	10:18.5	10:24.3	58.29.225N 003.3.144W	58.29.219N 003.2.912W	29.94	31.7	Gravelly sand, sand and scattered bedrock	Change to extensive bedrock at 10:21. Lots of empty mussel shells. 6 photos
04/09/11	Noss Head	NH41	5	11:09.1	11:15.1	58.26.439N 003.1.418W	58.26.308N 003.1.518W	41.91	42.78	Shell and gravel, occasional builders	6 photos, Brittlestar dominated
04/09/11	Noss Head	NH17	5	11:28	11:33.3	58.25.545N 003.2.464W	58.25.440N 003.2.374W	39.55	40	Gravelly sand and boulders	5 photos. Rocky reef and brittlestars
04/09/11	Noss Head	NH18	5	11:45.1	11:57.4	58.25.106N 003.3.240W	58.24.968N 003.3.140W	37.85	37.65	Gravelly shell with cobbles	Brittlestar dominated, TOW FAST. 7 photos
04/09/11	Noss Head	NH19	5	12:05.5	12:11.3	58.25.371N 003.1.283W	58.25.230N 003.1.166W	57.3	59	Gravel, shell and cobbles	Fast tow, 6 photos
04/09/11	Noss Head	NH32	6	12:27.1	12:32.4	58.25.350N 003.0.157W	58.25.255N 003.0.087W	64.19	63.7	Sand, Broken shell	6 photos. Sandy gravel and broken shell
04/09/11	Noss Head	NH26	6	12:52.3	12:58.4	58.26.163N 003.1.579W	58.26.060N 003.1.432W	43.41	44.39	Gravel and broken shell	Dominated by brittlestars. Fast tow. 7 Photos

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth	Dominant Substrate	Comments
04/09/11	Noss Head	NH39	6	13:15.5	13:21.1	58.26.214N 003.0.390W	58.26.121N 003.0.356W	56.55	58.74	Gravelly sand	Gravelly sand. 6 photos
05/09/11	Noss Head	NH28 (a)	7	07:17.1	07:19:38	58.30.893N 003.3.582W	58.30.954N 003.3.500W	42.56	42.98	Sand	Occasional boulders, 3 photos
05/09/11	Noss Head	NH28 (a)	7	07:29.1	07:32.0	58.31.016N 003.3.064W	58.31.064N 003.3.046W	44.77	45.2	Sand and Rock	4 photos, Lots of squat lobsters
05/09/11	Noss Head	NH58	7	07:50.6	07:55.1	58.31.367N 003.5.375W	58.31.414N 003.5.295W	25.49	25.34	Sand	5 Photos. Just sand waves
05/09/11	Noss Head	NH56	7	08:22	08:28.6	58.31.414N 003.0.115W	58.31.507N 002.59.955W	61.95	61.68	Gravelly sand	6 photos
05/09/11	Noss Head	NH57	7	08:44.6	08:50.1	58.31.416N 002.58.472W	58.31.507N 002.58.434W	52.8	54.78	Sand	6 Photos, just sand
05/09/11	Noss Head	NH54	7	09:09.5	09:14.5	58.30.385N 002.58.199W	58.30.446N 002.58.199W	66.62	66.97	Sand	6 photos
05/09/11	Noss Head	NH55	7	09:36.5	09:41.2	58.30.447N 003.1.147W	58.30.522N 003.1.158W	53.97	53.72	Sand and cobbles	Changes to shell and gravel at 09:37. 6 photos
05/09/11	Noss Head	NH16	7	10:00.4	10:05.3	58.29.363N 002.59.535W	58.29.411N 002.59.474W	61.88	61.75	Shell and gravelly sand, with cobbles.	Occasional boulders. 5 photos

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05/09/11	Noss Head	NH53	7	10:17.6	10:23.4	58.29.270N 002.58.102W	58.29.376N 002.58.018W	64.49	65.02	Sand and rock	Onto sand at 10:22 for few seconds then more rock. 7 photos
05/09/11	Noss Head	NH51	8	12:38.1	12:43.3	58.28.645N 002.58.627W	58.28.600N 002.58.541W	54.25	54.4	Sand	Occasional boulders covered in sponge/algae. 6 photos
05/09/11	Noss Head	NH52	8	12:55.5	12:59.6	58.28.479N 002.57.344W	58.28.455N 002.57.277W	57.69	59.77	Sand	Sand. 5 photos
05/09/11	Noss Head	NH59	8	13:12.0	13:15.2	58.28.922N 002.57.966W	58.28.882N 002.57.945W	46.85	52.4	Sand	Sand.3 photos

Appendix 3. Southern Trench Drop down video field log - Details of taxa observed can be seen in Appendix 5

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
06/09/11	Southern Trench	ST43	1	07:18.2	07:28.5	57.42.609N 002.39.416W	57.42.711N 002.39.251W	34.49	34.09	Sand	Change to shell/gravel at 07:24, with bigger boulders at 07:26 and change to sand at end.11 photos
06/09/11	Southern Trench	ST3	1	07:46.1	07:56.3	57.44.151N 002.37.709W	57.44.239N 002.37.516W	62.36	62.16	Silt/Fine mud	11 photos. Grab 1
06/09/11	Southern Trench	ST52	1	08:38.3	08:47.5	57.47.064N 002.39.454W	57.47.134N 002.39.276W	95.36	94.73	Burrowed mud	Tape 1 continued onto tape 2. 9 photos.
06/09/11	Southern Trench	ST5	2	09:13	09:23.0	57.46.946N 002.35.161W	57.47.008N 002.34.788W	86.13	86.5	Burrowed mud	9 photos, Sea pen at 09:17
06/09/11	Southern Trench	ST37	2	09:38.0	09:47.5	57.47.110N 002.33.327W	57.47.162N 002.33.019W	72.96	72.56	Burrowed mud	9 Photos. Grab 2. Muddy sand/burrowed mud
06/09/11	Southern Trench	ST8	2	10:13.3	10:23.1	57.48.433N 002.31.368W	57.48.461N 002.31.137W	92.24	92.45	Burrowed mud	9 photos, fast tow
06/09/11	Southern Trench	ST1	2	11:13.6	11:23.4	57.45.151N 002.31.913W	57.45.205N 002.31.662W	99.11	99.79	Burrowed mud	10 photos. Image bit soft
06/09/11	Southern Trench	ST64	3	11:58.2	12:07.5	57.42.427N 002.34.202W	57.42.368N 002.34.363W	38.55	37.71	Sand/Sandy mud	10 photos. Bit soft

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06/09/11	Southern Trench	ST22	3	12:31.1	12:40.3	57.43.594N 002.30.890W	57.43.616N 002.30.626W	73.08	73.05	Burrowed mud	10 photos, *Alcyonium* at 12:33?, quite far from original station.
06/09/11	Southern Trench	ST65	3	12:59.1	13:08.4	57.42.534N 002.29.149W	57.42.604N 002.29.035W	38.11	38.24	Gravel and pebbles	11 photos, change to boulders at end
06/09/11	Southern Trench	ST41	3	13:29.5	13:39.2	57.44.103N 002.26.960W	57.44.179N 002.26.814W	43.66	43.57	Sandy mud with pebbles and cobbles and occasional boulders	10 photos.
06/09/11	Southern Trench	ST 19	3	14:02.4	14:12.2	57.45.584N 002.28.392W	57.45.671N 002.28.493W	122.67	115.9	Burrowed mud and mud	9 photos. Grab 3
06/09/11	Southern Trench	ST61	4	14:39.4	14.50.07	57.47.060N 002.28.422W	57.47.183N 002.28.322W	86.55	87.46	Burrowed mud	11 photos
06/09/11	Southern Trench	ST44	4	15:11.3	15:21.2	57.46.504N 002.26.14W	57.46.473N 002.25.780W	108.33	110.6	Burrowed mud	Trawl mark at 15:19
06/09/11	Southern Trench	ST68	4	16:09.1	16:18.6	57.45.367N 002.25.979W	57.45.468N 002.25.739W	141.92	135.61	Burrowed mud	10 photos. Big metal box at end
07.09.11	Southern Trench	ST25	5	11:31.1	11:40.3	57.43.427N 1.57.969W	57.43.382N 1.57.709W	43.75	43.13	Sand and rock	10 photos, 2 poss. not taken. Mainly sand

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
07.09.11	Southern Trench	ST29	5	12:01.4	12:11.2	57.45.548N 1.57.544W	57.45.645N 1.57.352W	56.53	57.24	Muddy gravel	10 photos. Rope on transect, occasional boulders.
07.09.11	Southern Trench	ST26	5	12:29.3	12:39.5	57.47.084N 001.57.107W	57.47.245N 001.56.907W	76.1	78.11	Muddy sand	10 photos, 2 possibly not taken. Camera bouncy
07.09.11	Southern Trench	ST51	5	13:09.4	13:26.4	57.48.699N 001.55.864W	57.48.766N 001.55.379W	202.05	207.32	Sandy mud	13 photos not at regular intervals. Camera bouncy
07.09.11	Southern Trench	ST12	6	13:53.2	14:03.4	57.50.203N 001.57.529W	57.50.265N 001.57.316W	117.55	108.36	Mud/burrowed mud	8 photos, camera bouncy. Sea pen at 14:00
08.09.11	Southern Trench	ST 23	6	07:47.1	07:57.6	57.46.229N 001.48.688W	57.46.114N 001.47.975W	53.28	57.83	Pebbles and cobbles.	11 photos. Fast tow
08.09.11	Southern Trench	ST34	6	08:26.2	08:36.4	57.48.194N 001.46.392W	57.48.098N 001.45.775W	82.17	82.42	Gravelly sand	11 photos, rubble at end of transect. Grab 5
08.09.11	Southern Trench	ST36	6	09:20.5	09:30.2	57.49.008N 001.40.345W	57.48.913N 001.39.842W	54	55.44	Sand, pebbles and cobbles	
08.09.11	Southern Trench	ST35	7	09:59.2	10:09.5	57.50.374N 001.35.190W	57.50.261N 001.34.594W	65.37	64.9	Sandy mud and pebbles	11 photos, bit fast.

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08.09.11	Southern Trench	ST40	7	11:11.2	11:21.4	57.51.278N 001.38.871W	57.51.273N 001.38.267W	113.72	113.85	Muddy Sand	11 photos, camera tow a bit fast. Grab 6
08.09.11	Southern Trench	ST28	7	11:54.1	12:06.3	57.53.177N 001.38.114W	57.53.146N 001.37.686W	77.82	78.71	Muddy Sand	12 photos. Camera very bouncy.
08.09.11	Southern Trench	ST17	7	12:41.6	12:52.1	57.53.312N 001.44.487W	57.53.372N 001.44.212W	72.29	73.84	Muddy Sand	10 Photos. Camera very bouncy
08.09.11	Southern Trench	ST55	8	13:18.2	13:29.1	57.51.219N 001.43.184W	57.51.269N 001.42.793W	113.34	120.87	Mud	11 photos. Camera very bouncy.
08.09.11	Southern Trench	ST60	8	13:49.3	13:59.4	57.50.180N 001.43.393W	57.50.228N 001.43.189W	82.75	79.04	Sandy mud and pebbles	10 photos, Camera a bit bouncy
08.09.11	Southern Trench	ST11	8	14:23.3	14:36.2	57.50.348N 001.46.547W	57.50.474N 001.46.314W	163.81	153.28	Sandy Mud	12 photos, fish? At 14:30
08.09.11	Southern Trench	ST59	8	15:22.2	15:37.2	57.50.626N 001.48.946W	57.50.839N 001.48.752W	111.15	80.23	Mud and Pebbles	12 photos. 15:28 onwards bad viz, sloping upwards.
08.09.11	Southern Trench	ST50	9	16:14.6	16:26.2	57.50.496N 001.52.327W	57.50.606N 001.52.222W	107.05	97.39	Mud and Pebbles	11 photos, ray at end, and large anemone

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08.09.11	Southern Trench	ST15	9	17:02.6	17:16.5	57.50.215N 001.50.378W	57.50.399N 001.50.349W	168.3	108.44	Sandy mud/Mud	14 photos, lots of starfish
08.09.11	Southern Trench	ST45	9	17:36.1	17:45.4	57.49.274N 001.48.788W	57.49.365N 001.48.650W	106.04	107.28	Sandy mud	10 photos
09.09.11	Southern Trench	ST71	9	08:08.2	08:21.4	57.49.527N 001.49.665W	57.49.492N 001.49.478W	148.01	137	Gravelly mud	Drop camera frame. Clapper board at end of clip on DVD. Drifting along slope then upwards at 08:17.
09.09.11	Southern Trench	ST72	9	08:39.3	08:57.1	57.49.356N 001.50.701W	57.49.234N 001.50.352W	192.44	139.39	Sandy Mud	Drop camera frame. Going up gentle slope. 15 photos.
09.09.11	Southern Trench	ST27	9	09:56.3	11:11.0	57.49.376N 001.53.844W	57.49.433N 001.53.348W	205.4	196.15	Sandy Mud	Back to camera sledge. 14 photos. Possible sea pen at 10:00. Bad viz. Swapped camera, but identical set up. Big anemone at 10:07.
08.09.11	Southern Trench	ST11	8	14:23.3	14:36.2	57.50.348N 001.46.547W	57.50.474N 001.46.314W	163.81	153.28	Sandy Mud	12 photos, fish? at 14:30.10
08.09.11	Southern Trench	ST59	8	15:22.2	15:37.2	57.50.626N 001.48.946W	57.50.839N 001.48.752W	111.15	80.23	Mud and Pebbles	12 photos. 15:28 onwards bad viz, sloping upwards.

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09.09.11	Southern Trench	ST67	10	10:54.5	11:05.1	57.52.242N 001.48.159W	57.52.294N 001.47.987W	88.58	88.57	Burrowed mud/Mud	11 Photos
09.09.11	Southern Trench	ST9	10	11:30.4	11:40.5	57.52.377N 001.52.503W	57.52.293N 001.52.293W	92.22	92.45	Burrowed Mud	9 photos
09.09.11	Southern Trench	ST16	11	12:34.2	12:44.3	57.51.704N 002.0.083W	57.51.770N 001.59.862W	87.73	85.4	Burrowed Mud	10 photos
09.09.11	Southern Trench	ST18	11	13:14.4	13:24.4	57.50.221N 002.4.419W	57.50.358N 002.4.448W	95.59	90.06	Burrowed Mud	10 photos, bad viz
09.09.11	Southern Trench	ST21	11	13:56.4	14:06.5	57.48.367N 002.0.438W	57.48.470N 002.0.333W	132.4	130.54	Burrowed mud	9 photos, bad viz. Grab 10
09.09.11	Southern Trench	ST39	12	14.38.01	14:48.4	57.47.782N 002.1;.529W	57.47.882N 002.1.761W	213.98	209.75	Sand/Sandy mud	13 Photos, Clapper at end of tow
09.09.11	Southern Trench	ST66	12	15:16.0	15:26.4	57.48.567N 002.5.693W	57.48.676N 002.5.950W	125.51	100.6	Burrowed mud	11 photos, Grab 11
09.09.11	Southern Trench	ST63	12	16:21.2	16:32.1	57.47.141N 002.6.463W	57.47.313N 002.6.401W	113.08	100.31	Burrowed Mud	11 photos, bad viz

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09.09.11	Southern Trench	ST57	12	17:07.1	17:17.4	57.45.225N 002.7.143W	57.45.324N 002.7.381W	136.74	136.74	Burrowed mud	11 photos
09.09.11	Southern Trench	ST48	12	17:41.4	17:52.4	57.45.293N 002.10.401W	57.45.366N 002.10.175W	155.9	128.39	Mud/Burrowed mud	9 photos, bad viz
10.09.11	Southern Trench	ST31	13	07:19.2	07:29.5	57.43.788N 002.12.576W	57.43.842N 002.12.755W	43.09	42.3	Sand , cobbles and pebbles	11 photos, viz a bit hazy
10.09.11	Southern Trench	ST46	13	08:03.3	08:12.4	57.43.230N 002.18.417W	57.43.296N 002.18.672W	41.91	40.87	Gravelly sand and cobbles	11 photos, 5 may not have taken. Occasional boulders, more rocky towards end of transect
10.09.11	Southern Trench	ST13	13	08:34.3	08:44.1	57.43.235N 002.22.370W	57.43.264N 002.22.476W	49.34	49.04	Sand and pebbles	Grab 13, 10 photos
10.09.11	Southern Trench	ST10	13	09:05.3	09:15.3	57.44.449N 002.20.093W	57.44.580N 002.19.956W	79.25	86.49	Burrowed mud	10 photos
10.09.11	Southern Trench	ST47	13	09:31.6	09:42.4	57.45.584N 002.18.393W	57.45.686N 002.18.175W	172.1	154.96	Burrowed mud	9 photos bad viz. Grab 14

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10.09.11	Southern Trench	ST62	14	10:57.5	11:08.1	57.45.658N 002.21.302W	57.45.732N 002.21.065W	122.1	130.56	Burrowed mud	10 photos, bad viz
10.09.11	Southern Trench	ST4	14	11:29.5	11:40.2	57.45.630N 002.23.365W	57.45.717N 002.23.151W	110	112.06	Sandy mud, pebbles and cobbles	11 photos. Grab 15
10.09.11	Southern Trench	ST69	14	12:07.1	12:18.1	57.47.178N 002.24.027W	57.47.294N 002.23.896W	101.54	99.61	Burrowed mud	11 photos, timer on video late by 3 mins. Bad viz
10.09.11	Southern Trench	ST38	14	12:31.1	12:41.5	57.47.089N 002.22.799W	57.47.221N 002.22.654W	102.77	104.54	Burrowed mud	Hazy, bad viz. 11 photos
10.09.11	Southern Trench	ST70	14	13:04.4	13:16.5	57.46.413N 002.19.223W	57.46.592N 002.18.880W	87.43	70.04	Burrowed Mud/Mud	Hazy, bad viz. DVD slightly longer than DV tape, which ran out.
10.09.11	Southern Trench	ST7	15	13:31.6	13:42.2	57.47.493N 002.19.386W	57.47.624N 002.19.225W	114.72	120.02	Burrowed Mud	9 photos, Hazy, bad viz
10.09.11	Southern Trench	ST58	15	14:11.3	14:22.3	57.47.276N 002.17.578W	57.47.343N 002.17.731W	121.49	122.02	Burrowed Mud	15 photos
10.09.11	Southern Trench	ST54	15	14:44.4	14:54.3	57.47.416N 002.15.258W	57.47.527N 002.15.454W	126.19	120.76	Burrowed mud	10 photos, bad viz

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
10.09.11	Southern Trench	ST42	15	15:59.5	16:15.4	57.47.011N 002.10.256W	57.46.818N 002.10.348W	117	86.95	Mud/Broken Shell	16 photos Sloping
10.09.11	Southern Trench	ST2	16	16:47.2	16:57.3	57.46.034N 002.14.347W	57.45.958N 002.14.538W	108.81	112.56	Burrowed Mud	10 photos. Heavily burrowed. Station moved due to wreck being present
10.09.11	Southern Trench	ST56	16	17:15.6	17:27.1	57.45.358N 002.16.238W	57.45.270N 002.16.313W	171.06	188.26	Burrowed Mud	9 photos. Bad viz
10.09.11	Southern Trench	ST73	16	17:49.3	18:13.5	57.44.510N 002.14.537W	57.44.200N 002.14.554W	170.23	45.36	Burrowed mud	23 photos. Turning to pebbles towards end
11.09.11	Southern Trench	ST6	17	08:13:50	08:24.2	57.48.629N 002.22.973W	57.48.767N 002.23.057W	97.81	95.7	Burrowed Mud	NO STILLS. GPS track every min only.
11.09.11	Southern Trench	ST53	17	09:00.1	09:10.3	57.50.224N 002.17.449W	57.50.298N 002.17.553W	90.56	89.94	Burrowed Mud	NO STILLS. Grab 18
11.09.11	Southern Trench	ST20	17	09:43.3	09:54.1	57.49.254N 002.13.119W	57.49.316N 002.13.222W	99.23	99.4	Burrowed Mud	NO STILLS
11.09.11	Southern Trench	ST49	17	10:19.2	10:29.3	57.50.127N 002.9.364W	57.50.068N 002.9.529W	108.91	108.18	Burrowed Mud	10 photos, flash not working

Date	Location	Station	DVD No	Start Time (GMT)	End Time (GMT)	Start Coordinates	End Coordinates	Start Depth (m)	End Depth (m)	Dominant Substrate	Comments
11.09.11	Southern Trench	ST32	17	11:18.2	11:30.5	57.48.157N 002.7.965W	57.48.241N 002.8.022W	99.55	97.78	Burrowed Mud/ Mud	11 photos
11.09.11	Southern Trench	ST33	18	11:58.3	12:11.4	57.49.910N 002.8.276W	57.47.054N 002.8.085W	153.4	178.45	Mud and cobbles with rock outcrop	14 photos, interesting drop off rock outcrop at 12:03.
11.09.11	Southern Trench	ST24	18	12:33.3	12:48.5	57.46.063N 002.7.392W	57.46.301N 002.7.188W	153.58	88.68	Mud and pebbles/cobbles	17 photos. Grab 19
11.09.11	Southern Trench	ST14	18	13:40.5	13:52.0	57.43.492N 002.6.953W	57.43.704N 002.6.861W	50.36	52.34	Gravelly Sand	12 photos, no flash
11.09.11	Southern Trench	ST30	18	14:13.2	14:23.2	57.44.193N 002.2.197W	57.44.337N 002.2.181W	40.12	40.24	Gravelly with pebbles and cobbles	NO STILLS. GPS track every second
11.09.11	Southern Trench	ST74	19	14:41.4	14:49.4	57.45.770N 002.0.190W	57.45.874N 002.0.145W	68.43	67.23	Gravelly sand and pebbles	NO STILLS, Grab 20

Appendix 4. Biotope list for stations at Noss Head: *Substrates, biota, biotopes and PMFs/MPA search features recorded during the drop-down video survey.*

Station	Substrate	Biota	Biotope	PMFs
NH27	Brittlestar bed over cobbles, pebbles, boulders and patches of gravel and shell.	Dense Brittlestar cover *Ophiothrix fragilis* (S), *Ophiocomina nigra* (S), with Abundant *Alcyonium digitatum* supporting a community of *Echinus esculentus* (35), *Asterias rubens* (5), *Flustra foliacea* (O), sponge and hydroid turfs (R)	SS.SMx.CMx.OphMx	None
NH11	*Modiolus* bed interspersed with areas of dead shell and gravel and occasional Boulders and cobbles.	*Modiolus* bed with live *Modiolus* (A), supporting a highly biodiverse community of Hydroids including *Sertularia cupressina* (O), *Abieternaria abietina* (R), *Halecium* sp. (F), *Nemertesia antennina* (R), *Kirchenpaueria pinnata* (F) as well as mobile fauna such as *Ophiothrix fragilis* (A), *Ophiocomina nigra* (S) *Echinus esculentus* (112), *Asterias rubens*(16), *Henricia* sp. (10)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH14	Brittlestar bed over cobbles, pebbles, boulders and patches of gravel and empty shell.	Dense Brittlestar cover *Ophiothrix fragilis* (S), *Ophiocomina nigra* (S), with Abundant *Alcyonium digitatum* supporting a community of *Echinus esculentus* (51), Asterias rubens(9), *Pomatoceros triqueter* (F) sponge and hydroid turfs (R)	SS.SMx.CMx.OphMx	None
NH34	Shell mixed with gravel with patchy Brittlestar bed	Locally abundant Ophiothrix fragilis, and *Ophiocomina nigra* with a sparser community of *Echinus esculentus* (30), *Pomatoceros triqueter* (R), Hydroids (R), *Asterias rubens*(4), *Crossaster papposus* (6), and *Pagurus bernhardus* (5)	SS.SMx.CMx	None

Station	Substrate	Biota	Biotope	PMFs
NH8	Gravel with scattered cobbles and shell	Dominated by *Echinus esculentus* (26), *and Asterias rubens* (15), with Rare Red Algae Spp, and Sponge Spp, *Hydrallmania falcata* (O), *Alcyonidium diaphanum* (O), *Modiolus modiolus* (R).	SS.SMx.CMx	None
NH47	*Modiolus* bed with patches of empty shell	*Modiolus* bed with live *Modiolus* (S), supporting a highly biodiverse community of Hydroids including *Kirchenpaueria pinnata* (S) *Sertularia cupressina* (C) and *Schizotricha frutescens* (S) , Massive yellow sponge Sp (C), the seasquirt *Ascidia virginea* (C) as well as mobile fauna such as *Ophiothrix fragilis*, and *Ophiocomina nigra* (S) , *Echinus esculentus* (48), and *Henricia sp* .(12)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH21	*Modiolus* bed with patches of empty shell	*Modiolus* bed with live *Modiolus* (S), supporting a highly biodiverse community of Hydroids including *Nemertesia antennina* (R), *Kirchenpaueria pinnata* (F), Bryozoans such as *Parasmitina tripspinosa* (O) as well as mobile fauna such as Ophiothrix fragilis (O),*Echinus esculentus (*24), *Asterias rubens*(8)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH5	Coarse grain sands with patches scattered shell and patches of pebbles	Extremely sparse habitat with only *Pagurus bernhardus* (1), *Asterias rubens* (1), *Limanda limanda* (1), and Crab sp. (1)	SS.SCS.CCS	None
NH15	Coarse grain sands	Extremely sparse habitat with only *Echinus esculentus* (1), *Hyperoplus lanceolatus* (7), and Algae Spp (R) attached to detritus.	SS.SCS.CCS	None

Station	Substrate	Biota	Biotope	PMFs
NH46	*Modiolus* bed interspersed with areas of dead shell and gravel and occasional cobbles.	*Modiolus* bed with live *Modiolus* (A), supporting a highly biodiverse community of Hydroids including *Sertularia cupressina* (A), *Halecium sp.* (A), and *Kirchenpaueria pinnata* (A) as well as mobile fauna such as *Echinus esculentus* (96), *Asterias rubens*(24), *Ophiothrix fragilis* (F), *Alcyonium digitatum*, *Pomatoceros triqueter* (O), and Rare Encrusting Sponge Spp, and Bryozoans.	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus* bed
NH45	Gravelly coarse sand	Extremely sparsely populated with only *Alcyonidium diaphanum* (R), and *Hyperoplus lanceolatus* (5)	SS.SCS.CCS	None
NH29	Brittlestar bed over cobbles and pebbles	Brittlestar bed of *Ophiothrix fragilis* (S), and *Ophiocomina nigra* (O), with *Alcyonium digitatum* (A), Pomatoceros triqueter (C), *Echinus esculentus* (43) and *Flustra foliacea* (O). Less abundant fauna included Encrusting Sponge sp. (R), Massive yellow sponge sp. (R) and *Nemertesia antennina* (R)	SS.SMx.CMx.OphMx	None
NH35	Gravel with scattered shell and pebbles with occasional boulders	Sparsely populated station with (O) *Pomatoceros triqueter* and *Flustra foliacea, Echinus esculentus* (16) , and Rare *Hydrallmania falcata*, Encrusting Sponge sp., and *Schizotricha frutescens*	SS.SMx.CMx	None
NH36	Gravel with scattered shell and pebbles	Fairly sparse station dominated by Occasional Hydroids *Sertularia cupressina*, *Halecium sp.* and *Hydrallmania falcata*, with *Pomatoceros triqueter* (F), *Echinus esculentus* (21), and *Rhodophyta sp.* (R),	SS.SMx.CMx	None

Station	Substrate	Biota	Biotope	PMFs
NH48	Cobbles and pebbles with patchy gravelly sand	Fairly sparse station dominated by *Flustra foliacea* (F), *Pomatoceros triqueter* (O*), Sertularia cupressina* (O), *Schizotricha frutescens* (R) and *Echinus esculentus* (41)	SS.SMx.CMx.FluHyd	None
NH37	*Modiolus* bed with empty shell, shell gravel and coarse sand	*Modiolus* bed with Live *Modiolus* (A), supporting a community of *Ophiothrix fragilis* (S*), Ophiocomina nigra* (S), *Echinus esculentus* (111), *Asterias rubens* (26), *Flustra foliacea* (C), *Sertularia cupressina* (A), and *Cucumaria frondosa* (6)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH50	*Modiolus* bed with empty shell, shell gravel and coarse sand	*Modiolus bed* with Live *Modiolu*s (A), supporting a diverse community of Ophiothrix fragilis (S), , *Echinus esculentus* (120), *Asterias rubens* (37), Encrusting Sponge Sp (C), *Henricia Sp* (27), *Sertularia cupressina* (A), and *Kirchenpaueria pinnata* (C) as well as individuals of Fish species.	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*, and Spiny dogfish (*Squalus acanthias*)
NH43	*Modiolus* bed with empty shell, shell gravel and coarse sand	*Modiolu*s bed with Live *Modiolus* (A), supporting a diverse community dominated by *Echinus esculentus* (140), *Asterias rubens* (56), Encrusting Sponge sp. (C), *Henricia sp.* (12), *Sertularia cupressina* (S), and *Halecium sp.* (A). With less abundant species such as *Buccinum undatum* (1), *Pholis gunnellus* (1), and *Ascidia virginea* (3).	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*, and European eel (marine stage; *Anguilla anguilla*)

Station	Substrate	Biota	Biotope	PMFs
NH4	*Modiolus* bed with empty shell and sandy gravel patches	*Modiolus* bed with Live *Modiolus* (F), *Ophiothrix fragilis* (A), *Echinus esculentus* (130), Encrusting Sponge sp (C), *Sertularia cupressina* (F), *Kirchenpaueria pinnata* (F), and Bryozoa indet crusts (O)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH44	*Modiolus* bed with empty shell and sandy gravel patches	*Modiolus* bed with Live *Modiolus* (F), Ophiothrix fragilis (A), *Echinus esculentus* (126), Encrusting Sponge sp (O), *Sertularia cupressina* (A), *Schizotricha frutescens* (O), and Bryozoa indet crusts (R)	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*
NH42	Brittlestar bed on gravelly sand and shell	Brittlestar bed heavily dominated by *Ophiothrix fragilis* (S), with little else but *Echinus esculentus* (53), Encrusting Sponge sp. (O), *Sertularia cupressina* (R), *Hydrallmania falcata* (R) and *Buccinum undatum* (1)	SS.SMx.CMx.OphMx	None
NH1	Brittlestar bed on gravelly sand and shell with occasional boulders	Brittlestar bed heavily dominated by *Ophiothrix fragilis* (A), Corallinaceae indet pink crusts (O), *Spirobranchus triqueter* (F),*Echinus esculentus* (33), and rare Hydroids, Bryozoa, and Sponges	SS.SMx.CMx.OphMx	None
NH49	*Modiolus* bed with empty shell, shell gravel and coarse sand	*Modiolus* bed with Live *Modiolus* (A), supporting a diverse community dominated by *Ophiothrix fragilis* (A), *Sertularia cupressina* (F), *Echinus esculentus* (73), *Asterias rubens* (26), *Halecium* sp.(O), and *Kirchenpaueria pinnata* (O).	SS.SBR.SMus.ModT	Horse Mussel *Modiolus modiolus*

Station	Substrate	Biota	Biotope	PMFs
NH33	Coarse sands and gravel with cobbles and occasional boulders with bedrock at end of transect	Dominated by *Flustra foliacea* (A), Brittlestars *Ophiothrix fragilis* (C), *Ophiocomina nigra* (C), with Occasional Hydroids *Sertularia cupressina*, *Abietinaria abietina, Halecium* sp. and *Echinus esculentus* (54).	SS.SMx.CMx	None
NH30	Cobbles and pebbles on gravelly sand	Diverse Habitat dominated by *Flustra foliacea* (C), Bryozoa indet crusts (O), *Echinus esculentus* (30), Rare Hydroids and invertebrates	SS.SMx.CMx	None
NH13	Boulders and bedrock on gravelly sand	Dominated by Crustacea sp. (S), *Spirobranchus triqueter* (A), *Myxilla* sp. (A), *Parasmitina tripspinosa* (C), and *Ophiothrix fragilis* (C).	CR.MCR.EcCr.FaAlCr	Spiny dogfish (*Squalus acanthias*)
NH7	Fine and medium sands	Extremely sparse with only *Pagurus bernhardus* (1)	SS.SSA.CFiSa	None
NH10	Gravelly sand with coarse sand patches and occasional boulders	*Ophiothrix fragilis* (A), Crustacea sp. (A), *Echinus esculentus* (57), *Parasmitina tripspinosa* (F), with Occasional *Flustra foliacea* and Encrusting Sponge sp. Also individual *Hippasteria phrygiana*, and *Munida* sp.	SS.SMx.CMx	None
NH28	Brittlestars on Large boulders and bedrock with sandy patches	Super Abundant Brittlestars *Ophiothrix fragilis* locally, *Alcyonium digitatum* (O), *Echinus esculentus* (110), *Parasmitina tripspinosa* (O), and Occasional *Myxilla sp.*	CR.MCR.EcCr.FaAlCr.Bri	None
NH23	Cobbles and small boulders on gravely sand	*Ophiothrix fragilis* (C), Encrusting Porifera sp. (O), *Flustra foliacea* (O), *Parasmitina tripspinosa* (O), *Sertularia cupressina* (O), and Rare *Schizomavella* sp.	SS.SMx.CMx	None

Station	Substrate	Biota	Biotope	PMFs
NH3A	Scattered shell and gravel	Sparse station with *Alcyonidium diaphanum* (C), Encrusting Porifera sp. (O), *Flustra foliacea* (F), Corallinaceae indet pink crusts (F*), Hydroidea* sp. (R), *Echinus esculentus* (10), and *Crossaster pappo*sus (2).	SS.SMx.CMx	None
NH3B	Bedrock with patches of gravel and shell	Common encrusting fauna such as *Parasmitina tripspinosa, Alcyonidium diaphanum*, Encrusting Porifera sp. (O), Bryozoa indet crusts (O), Corallinaceae indet pink crusts (F), and Hydroids such as *Sertularia cupressina* (R), and *Hydrallmania falcata* (R). Lack of mobile fauna such as *Asterias rubens* (5)	CR.MCR.EcCr.FaAlCr	None
NH41	Brittlestars on shelly gravel with patches of bedrock and occasional boulders	Dense Brittlestar cover *Ophiothrix fragilis* (S), *Ophiocomina nigra* (S),*Sertularia cupressina* (O), *Hydrallmania falcata* (O), Encrusting Porifera sp. (O), *Echinus esculentus* (65), with little else such as *Cancer pagurus* (2), *Asterias rubens* (1), and *Lineus longissimus* (1).	SS.SMx.CMx.OphMx	None
NH17	Brittlestars on shelly gravel with patches of bedrock and occasional boulders	Dense Brittlestar bed dominated by *Ophiothrix fragilis* (S), *Alcyonium digitatum* (A) , *Echinus esculentus* (80), *Parasmitina tripspinosa* (O) and *Sertularia cupressina* (O)	SS.SMx.CMx.OphMx	None
NH18	Brittlestars on shelly gravel with patches of bedrock and occasional boulders	Dense Brittlestar cover *Ophiothrix fragilis* (S), *Ophiocomina nigra* (S),*Alcyonium digitatum* (A), *Parasmitina tripspinosa* (A), *Echinus esculentus* (134), Encrusting Porifera sp. (C), *Flustra foliacea* (F), Hydroids (R-C), *Lanice conchilega* (4), and Pisces sp. (12).	SS.SMx.CMx.OphMx	None

Station	Substrate	Biota	Biotope	PMFs
NH19	Gravelly sands with pebbles and shell	*Spirobranchus triqueter* (A), *Ophiothrix fragilis* (C), *Echinus esculentus* (46), *Flustra foliacea* (O), Encrusting Porifera sp. (O), with abundant *Lanice conchilega* (31), and *Salmacina dysteri* (R)	SS.SMx.CMx	None
NH32	Gravelly sand patches with cobbles and pebbles with occasional small boulders	Little mobile life, dominated by encrusting species. *Vesicularia spinosa* ? (C), *Eucratia loricata*? (O), *Halecium* sp. (C), *Echinus esculentus* (10)	SS.SMx.CMx.FluHyd	None
NH26	Pebbles on shelly gravel with empty shell and boulders	Dominated by *Alcyonium digitatum* (A), *Ophiothrix fragilis* Locally Super abundant, *Echinus esculentus* (80), Encrusting Porifera sp. (O), *Spirobranchus triqueter* (F), *Sertularia cupressina* (O), *Hydrallmania falcata* (O), and Rare Bryozoa indet crusts.	CR.MCR.EcCr.FaAl Cr.Bri	None
NH39	Pebbles and cobbles on gravelly shell and sand	Abundant *Spirobranchus triqueter* and *Flustra foliacea* with Common Hydroidea sp., also *Halecium s*p. (O), *Nemertesia antennina* (O), and *Hydrallmania falcata* (O), *Lanice conchilega* (21), and 12 Pisces sp.	SS.SMx.CMx.FluHyd	None
NH28A	Coarse gravelly sand and boulders	Dominated by Crustacea sp. (A), *Spirobranchus triqueter* (A), *Parasmitina tripspinosa* (C), *Alcyonium digitatum (*F), *Flustra foliacea* (F), Hydroidea sp. (O), and *Echinus esculentus* (37).	SS.SMx.CMx	None
NH58	Fine muddy sand with diatom films	Incredibly sparse with only *Asterias rubens* (1), *Liocarcinus depurator* (1), and Pleuronectiform sp. (1).	SS.SSa.CMuSa	None

Station	Substrate	Biota	Biotope	PMFs
NH56	Gravel and coarse sand with pebbles, cobbles	No species in great abundance. *Vesicularia spinosa* ? (C), *Nemertesia ramosa* (O), Corallinaceae indet pink crusts (O), *Flustra foliacea* (F*), Echinus esculentus* (6), and Rare Bryozoans, Hydroids and Sponge	SS.SMx.CMx.FluHyd	None
NH57	Mixed sand with scattered pebbles and shell	Extremely Sparse with only Hydroidea sp. (R), *Pagurus bernhardus* (1), Decapoda indet. (1), and *Hyperoplus lanceolatus* (4).	SS.SSa.CFiSa	None
NH54	Mixed sand with scattered pebbles and shell	Extremely Sparse with only *Pagurus bernhardus* (1), Flustra foliacea (R), Hydroidea sp. (R), and *Raja montagu*i (1).	SS.SSa.CFiSa	None
NH55	Patchy gravelly sand with pebbles and cobbles and rare boulders	*Flustra foliacea* (A), *Ophiothrix fragilis* (C), *Echinus esculentus* (48), *Spirobranchus triqueter* (F), *Parasmitina tripspinosa* (F), *Sertularia cupressina* (O), *Halecium sp.* (O),*Kirchenpaueria pinnata* (O), and Crustacea sp. (F).	SS.SMx.CMx	None
NH16	Cobbles and pebbles with coarse gravelly sand patches and rare boulders and scatter shell	Dominated by Flustra foliacea (F), *Spirobranchus triqueter* (C), *Ophiothrix fragilis* (Locally A), *Sertularia cupressina* (F), *Halecium* sp. (F), and Crustacea sp. (F).	SS.SMx.CMx.FluHyd	None
NH53	Mixed sand with cobbles, pebbles and occasional boulders	Dominated by *Nemertesia antennina*, and *Spirobranchus triqueter* (C), *Flustra foliacean* (F), *Sertularia cupressina* (F), *Halecium* sp. (F), and *Echinus esculentus* (13). With Rare *Janolus* sp. (1), and *Luidia ciliaris* (1).	SS.SMx.CMx	None
NH51	Mixed sand with cobbles and pebbles and rare boulders	Little life recorded, *Flustra foliacea* (F), *Sertularia cupressina* (O), *Nemertesia antennina* (O), Asteroidea sp. (1), *Munida* sp. (1), Encrusting Porifera sp. (R), *Spirobranchus triqueter* (R), and *Echinus esculentus* (4).	SS.SMx.CMx	None

Station	Substrate	Biota	Biotope	PMFs
NH52	Mixed sand with cobbles and pebbles and rare boulders	No single species dominating heavily. *Flustra foliacea* (F), Hydroidea sp. (O), *Sertularia cupressina* (O), *Nemertesia antennina* (O), Crustacea sp. (R), *Echinus esculentus* (5).	SS.SMx.CMx	None
NH59	Fine sand	No biota recorded	SS.SSA.CFiSa	None

Appendix 5. List of Biotopes found at each station within the Southern Trench survey area 2011.

Station	Substrate	Biota	Biotope	PMFs
ST43	Gravelly sand and Boulders with scattered small boulders, cobbles and pebbles	Dominated by Munida sp. (77), *Spirobranchus triqueter* (F), and *Alcyonium digitatum* (O) with Rare Encrusting Porifera sp., Hydroids and *Flustra foliacea*. Less abundant *Hyperoplus lanceolatus* (7), *Echinus esculentus* (5), *Asterias rubens* (5), AND *Liocarcinus depurator* (5)	SS.SMx.CMx	None
ST3	Sandy mud with scattered shell	Sparse station with most abundant organisms *Munida* sp. (9), *Asterias rubens* (9), Hyrdroid sp. (R), *Flustra foliacea* (R), and *Liocarcinus depurator* (6).	SS.SMu.Csa.Mu	None
ST52	Burrowed mud	Extremely sparse station with only Pisces sp. (3), AND *Goneplax rhomboides* (1)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST5	Burrowed mud	Sparse station with only *Pisces sp*. (17), *Liocarcinus depurator* (2), *Pennatula phosphorea* (2), *Nephrops norvegicus* (2), *Asterias rubens* (1), and Asteroidea sp. (1).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST37	Burrowed mud	Sparse station heavily dominated by *Pennatula phosphorea* (44), with rare *Virgularia mirabilis* (2), *Aequipecten opercularis* (1), *Luidia ciliaris* (1), *Nephrops norvegicus* (1), *Liocarcinus depurator*(1), and *Pagurus bernhardus* (1).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST8	Burrowed mud	Very little biota with only *Liocarcinus depurator* (1), Pisces sp.(1), *Pennatula phosphorea*(1), *Virgularia mirabilis*(1), Pleuronectiform sp. (1).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST1	Burrowed mud	Most abundant biota Pisces sp. (11), with only *Asterias rubens* (3), *Pagurus bernhardus*(2), *Liocarcinus depurator*(2), *Nephrops norvegicus* (2).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud

Station	Substrate	Biota	Biotope	PMFs
ST64	Sandy mud with scattered shell	Very little biota with only *Liocarcinus depurator* (3), Astropecten irregularis (3), *Asterias rubens* (2), *Pagurus bernhardus* (1), Pisces sp. (1), *Virgularia mirabilis(*1), and Pleuronectiform sp. (1)	SS.SSA	None
ST22	Burrowed mud with scattered shell	Sparse station not heavily dominated by any one species including *Alcyonium digitatum* (R), *Tubularia indivisa* (R), and *Omalesecosa ramulosa* (R) attached to loose material, with only 3 *Pennatula phosphorea.*	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST65	Muddy sand with cobbles, pebbles and occasional small boulders	Dominated by *Munida* sp. (20), with *Spirobranchus triqueter* (C *), Echinus esculentus* (9), *Omalesecosa ramulosa* (O), and *Parasmitina tripspinosa* (O).	SS.SMx.CMx	None
ST41	Mixed sand with cobbles, pebbles, small and large boulders	A variety of Hydroids including *Halecium* sp. *(*C), *Sertularia cupressina* (F), as well as bryozoans *Parasmitina tripspinosa* (O), and *Omalesecosa ramulosa* (R) with mobile fauna dominated by *Echinus esculentus* (12) and *Munida* sp. (8)	SS.SMx.CMx	None
ST19	Burrowed mud	Sparse station with only Pisces sp. (30), *Goneplax rhomboides* (1), *Nephrops norvegicus* (1*), Pennatula phosphorea* (1) *Astropecten irregularis* (1), and *Trisopterus luscus* (4).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST61	Burrowed mud	Sparse station with only *Pennatula phosphorea* (4) spread out throughout station, *Virgularia mirabilis* (2), Pleuronectiform sp. (1), and Rare *Tubularia indivisa* on drift material.	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST44	Burrowed mud	Large numbers of juvenile fish, Pisces sp. (100), but little other visible biota including Liocarcinus depurator (1), *Nephrops norvegicus* (3), Pleuronectiform sp. (1) and *Trisopterus luscus* (6).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST68	Burrowed mud	The most abundant species of *Astropecten irregularis* (8), Rare *Tubularia indivisa* on outcrops, *Melanogrammus aeglefinus* (2), *Virgularia mirabilis* (2), *Pennatula phosphorea* (3), *Nephrops norvegicus* (3), and *Pagurus bernhardus* (3).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud

Station	Substrate	Biota	Biotope	PMFs
ST25	Sandy mud with rare large boulder outcrops	Variety of organisms dominated by *Alcyonium digitatum* (F) on outcrops, *Munida* sp. (10), *Echinus esculentus* (6), Cirripedia sp. (O), and Hydroid sp. (O).	SS.SMu.CFiMu	None
ST29	Mixed gravelly sand with cobbles, pebbles and small boulders	Most abundant species *Alcyonium digitatum* (C), *Munida* sp. (12), *Flustra foliacea* (O), Spirobranchus *triqueter* (O), Hydroid sp. (O)	SS.SMx.CMx	None
ST26	Fine sand and shell	Few species recorded, *Alcyonium digitatum* (O*),Pagurus bernhardus* (1), *Pisces sp.* (1), *Luidia ciliaris* (6), *Hippasteria phrygiana* (2), Actiniaria indet. (2) and *Astropecten irregularis* (1).	SS.SSa	None
ST51	Fine Mud and shell	Dominated heavily by *Urticina eques* (67) with only a few other species including *Cerianthus lloydii* (3), *Pagurus bernhardus* (4), and *Asterias rubens* (2).	SS.SMu.CFiMu	None
ST12	Burrowed mud	Sparse station with only *Alcyonium digitatum* (R), *Pagurus bernhardus* (1), Pisces sp. (1), *Pennatula phosphorea* (1), *Nephrops norvegicus* (2).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST23	Gravelly mixed sand with cobbles and pebbles	Superabundant *Spirobranchus triqueter* on mixed rock with *Asterias rubens* (16), *Hippasteria phrygiana* (7), *Chaetopterus* sp. (Tubes) (3), Pisces sp. (6), and *Munida* sp. (8).	SS.SMx.CMx	None
ST34	Gravelly coarse sand and shell	*Munida* sp. (10), *Urticina eques* (2), *Alcyonium digitatum* (R), *Salmacina dysteri* (R) and individual records of species such as *Luidia ciliaris* and *Pleuronectes platessa*.	SS.SCS.CCS	None
ST36	Gravelly mixed sand with cobbles and abundant pebbles and scattered small boulders	Frequent *Flustra foliacea*, *Echinus esculentus* (22), *Spirobranchus triqueter* (S), *Sertularia cupressina* (O), *Hippasteria phrygiana* (6), *Luidia ciliaris* (7), the most abundant organisms recorded.	SS.SMx.CMx.FluHyd	None

Station	Substrate	Biota	Biotope	PMFs
ST35	Muddy sand with pebbles and cobbles	Dominated by Spirobranchus triqueter (A), *Echinus esculentus* (31), *Alcyonium digitatum* (O), *Hippasteria phrygiana* (3), *Luidia ciliaris* (3), with Rare *Flustra foliacea* and Hydroids.	SS.SMx.CMx	None
ST40	Muddy sand with scattered shell	Very sparse station with only Rare *Alcyonium digitatum*, *Pagurus bernhardus* (1), Pleuronectiform sp. (1), *Chaetopterus* sp. (Tubes) (3), and 1 *Eutrigla gurnardus.*	SS.SSa.CMuSa	None
ST28	Muddy sand with scattered shell	Very sparse station with only 4 *Ophiura ophiura*, Actiniaria indet. (1), *Bathyraja brachyurops* (1), *Astropecten irregularis* (3), and 4 *Pagurus bernhardus*.	SS.SSa.CMuSa	None
ST17	Muddy sand with scattered shell and small boulders	Not dominated by any one species but with individual counts of many including Rare Hydroid sp. And *Alcyonium digitatum*, *Urticina eques* (5), and single counts of *Cerianthus lloydii , Raja clavata* and *Trisopterus luscus.*	SS.SSa.CMuSa	None
ST55	Muddy sand	Dominated by juvenile Pisces sp. (100), and *Asterias rubens* (85), with Rare *Alcyonium digitatum*, and *Salmacina dysteri*, *Aequipecten opercularis* (6), *Pagurus bernhardus* (4*), Metridium senile* (2), and individual counts of species including Rajidae sp., and *Atelecyclus rotundatus*.	SS.SSa.CMuSa	None
ST60	Muddy sand with pebbles, cobbles and scattered shell	Sparse station mostly populated by *Alcyonium digitatum (*O), *Munida* sp. (9), *Pagurus bernhardus* (4), Rare Encrusting Porifera sp. And Hydroid sp. With 2 Dendrobranchiata sp.	SS.SSa.CMuSa	None

Station	Substrate	Biota	Biotope	PMFs
ST11	Muddy sand with pebbles and cobbles	Large numbers of *Urticina eques* (45), as well as *Alcyonium digitatum* (O), Rare *Flustra foliacea*, *Aequipecten opercularis* (9), and *Cerianthus lloydii* (2).	SS.SMu.CFiMu	None
ST59	Mixed sand with pebbles, cobbles some shell and scattered boulders	Common *Alcyonium digitatum*, 21 *Asterias rubens*, *Munida* sp. (3*), Actiniaria indet*. (2), *Merlangius merlangus* (2), as well as individual counts of other organisms.	SS.SMx.CMx	None
ST50	Fine mud with scattered shell and pebbles	Small counts of only a few species including *Metridium senile* (2), Rajidae sp. (1), *Cerianthus lloydii* (1), Hydroid sp. (R), *Omalesecosa ramulosa* and *Spirobranchus triqueter* (R on pebbles), and Rare *Salmacina dysteri*	SS.SMu.CFiMu	None
ST15	Fine mud with scatters shell, pebbles and rare boulders	Massively dominated by 280 *Asterias rubens*, Frequent *Alcyonium digitatum* on pebbles and boulders, with small counts of other species including *Salmacina dysteri* (R), *Urticina eques* (9), *Aequipecten opercularis* (14), *Metridium senile* (4), and Macropodia sp. (1).	SS.SMu.CFiMu	None
ST45	Fine mud with scatters shell, pebbles and rare boulders	Low numbers of species and counts with exception of *Urticina eques* (36), but with Rare *Alcyoniu*m *digitatum, Cerianthus lloydii* (4), and *Pagurus bernhardus* (3), being the highest counts.	SS.Smu.CFiMu	None
ST71	Mixed sands with pebbles and cobbles	Massively dominated by 320 *Urticina eques*, 34 *Asterias rubens*, *Alcyonium digitatum* (O), *Salmacina dysteri* (O), Encrusting Porifera sp. (O), and Common Hydroid sp.	SS.SMx.CMx	None
ST72	Sandy mud with scattered shell, pebbles and cobbles	Massively dominated by 500 *Urticina eques*, 200 *Asterias rubens, Cerianthus lloydii* (9), with Rare or individual counts of species such as *Salmacin*a *dysteri (*R), *Flustra foliacea* (R), *Bolocera tuediae* (1), and *Henricia s*p. (1).	SS.SMx.CMx	None

Station	Substrate	Biota	Biotope	PMFs
ST27	Fine mud with some shell	Low abundances of only a few species including 14 *Cerianthus lloydii* , *Metridium senile* (3), *Aequipecten opercularis* (9), *Holothuroidea* sp. (7), *Urticina eques* (12), and *Salmacina dysteri* (R).	SS.SMu.CFiMu	None
ST67	Burrowed mud with scattered shell	Dominated by *Pennatula phosphorea* (13), with Rare *Alcyonium digitatum*, and *Urticina eques* (2), and individual counts of species such *as Virgularia mirabilis.*	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST9	Burrowed mud with scattered shell	Dominated by *Pennatula phosphorea* (17), with only few other species such as Actiniaria indet. (3), *Bolocera tuediae* (2), and Rare *Alcyonium digitatum* on shell material	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST16	Burrowed mud with scattered shell	Dominated by *Pennatula phosphorea* (22), with only *Cerianthus lloydii* (5), and individual counts of species such as Actiniaria indet. (1), *Nephrops norvegicus* (1), Pisces sp. (1),	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST18	Burrowed mud with scattered shell	Dominated by juvenile fish Pisces sp. (100), Rare Porifera sp., *Pennatula phosphorea* (4), *Nephrops norvegicus* (2), and individual counts of species such as Pleuronectiform sp.	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST21	Burrowed mud with scattered shell	Little recorded life with only *Urticina eques* (3), *Pagurus bernhardus* (3), *Pennatula phosphorea* (1), Hydroid sp. (R on shell), and *Trisopterus luscus* (1), Decapoda sp. (1).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST39	Fine sand with scattered shell	Low records with Most abundant species *Aequipecten opercularis* (7), with *Urticina eques* (6), *Hyperoplus lanceolatus* (3), *Pagurus bernhardus* (3), *Asterias rubens* (2). Individual counts of species including Munida sp., *Pleuronectiform* sp., and Actiniaria indet.	SS.SMu.CFiMu	None

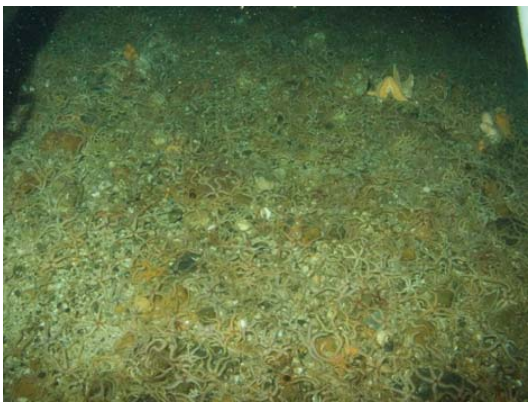
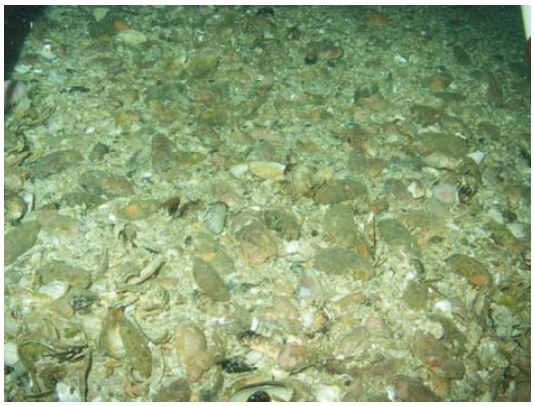
Station	Substrate	Biota	Biotope	PMFs
ST66	Burrowed mud with scattered shell	Extremely sparse station with only *Urticina eques* (1), *Pagurus bernhardus* (1), Pisces sp. (1), and *Pennatula phosphorea* (1).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST63	Burrowed mud	Dominated by 14 *Pennatula phosphorea*, Dendrobranchiata sp. (9),*Virgularia mirabilis* (2), AND individual counts of species including *Bolocera tuediae*	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST57	Fine mud with scattered shell, pebbles and boulders	Small counts of a few species the most abundant being *Urticina eques* (8), *Munida* sp. (6*), Asterias rubens* (5), and *Liocarcinus depurator* (3).	SS.SMu.CFiMu	None
ST48	Burrowed mud with scattered shell	Small numbers of typical soft sediment species including *Asterias rubens* (12), *Pagurus bernhardus* (9), *Nephrops norvegicus* (4), Hydroid sp. (R), Decapoda sp. (3) and *Gobius* sp. (3)	SS.SMu.CFiMu	None
ST31	Mixed muddy sand with pebbles, cobbles and small boulders	Mixed substrate dominated by Abundant *Spirobranchus triqueter*, and *Cirripedi*a sp. With Bryozoa sp. (O), Encrusting Porifera sp. (O), Hyrdroid sp. (R), and *Munida* sp. (9).	SS.SMx.CMx	None
ST46	Mixed muddy sand with pebbles, cobbles and small boulders	Mixed substrate dominated by Abundant *Spirobranchus triqueter*, and *Cirripedia* sp. With *Munida sp.* (7), Encrusting Porifera sp. (F), *Parasmitina tripspinosa* (F), Bryozoa sp. (F), and *Crossaster papposus* (2)	SS.SMx.CMx	None
ST13	Mixed muddy sand with pebbles, cobbles and small boulders	Mixed substrate dominated by Occasional *Spirobranchus triqueter*, and *Cirripedia s*p. With only *Liocarcinus depurator* (3), *Pleuronectiform sp*. (2), *Gobius* sp. (2), and individuals of *Pagurus bernhardus* , *Asterias rubens*.	SS.SMx.CMx	None
ST10	Burrowed mud with scattered shell	Sparse station with only *Pennatula phosphorea* (4), *Gobius* sp. (2), *Trisopterus luscus* (1), *Asterias rubens* (6), *Munida s*p. (5), and *Hyperoplus lanceolatus* (1)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud

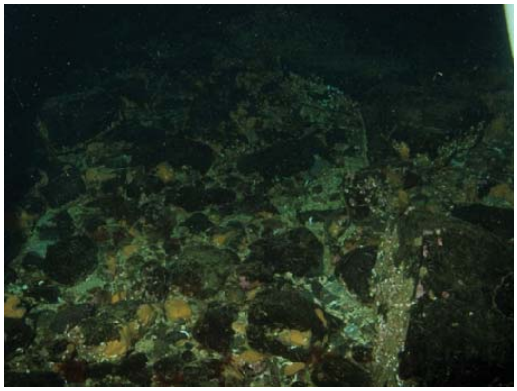
Station	Substrate	Biota	Biotope	PMFs
ST47	Burrowed mud with scattered shell	Extremely sparse station with the exception of large numbers of juvenile fish (100), *Goneplax rhomboides* (1), and *Sabella pavonina* (2)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST62	Burrowed mud with scattered shell	Extremely sparse station with only *Raja montagui* (1), Rare Hydroid sp. On shell, Pleuronectiform sp. (2), *Pennatula phosphorea* (5), *Liocarcinus depurator* (1), and Rare Encrusting Porifera sp. on loose material.	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST4	Mixed muddy sand with cobbles, pebbles and shell	*Munida s*p. (21), amongst pebbles and cobbles covered with *Salmacina dysteri* (O), Encrusting Porifera sp. (R), *Tubularia indivisa* (R), *Nemertesia antennina* (R), *Aiebetenaria aiebetenaria* (O), with *Dendrobranchiata* sp.	SS.SMx.CMx	None
ST69	Burrowed mud	Extremely sparse station with only *Gobius s*p. (1), Pisces sp. (7), *Asterias rubens* (1), *Pagurus bernhardus* (1), and *Pennatula phosphorea* (1)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST38	Burrowed mud with scattered shell	Station dominated by *Pisces sp*. (108), with only *Pagurus bernhardus* (1), *Liocarcinus depurator* (1), *Nephrops norvegicus* (1) and *Pennatula phosphorea* (1)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST70	Burrowed mud with scattered shell, cobbles and pebbles	*Munida sp.* (14), *Pagurus bernhardus* (9), *Asterias rubens* (6), Pisces sp. (5), *Pennatula phosphorea* (6), Rare Hydroids attached to loose material as well as small counts of other species such as *Metridium senile* (1), and *Gobius s*p. (1)	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST7	Burrowed mud with scattered shell	Only fish species recorded at this station with Pisces sp. (50), and *Hyperoplus lanceolatus* (1)	SS.SMu.CFiMu	None
ST58	Burrowed mud	Station sparse but again dominated by fish with Pisces sp. (12), *Pagurus bernhardus* (1), Asteroidea sp. (1), and *Nephrops norvegicus*(1).	SS.SMu.CFiMu	None

Station	Substrate	Biota	Biotope	PMFs
ST54	Burrowed mud	Only fish species recorded at this station with Pisces sp. (100)	SS.SMu.CFiMu	None
ST42	Sandy mud with pebbles shell and scattered boulders	Occasional *Salmacina dysteri* with *Munida* sp. (16), rock covered by Rare Encrusting Porifera sp., *Omalesecosa ramulosa* , Hydroid sp., and *Metridium senile* (1)	SS.SMx.CMx	None
ST2	Burrowed mud	Dominated by Pisces sp. (2) but with possible Rare *Alcyonidium diaphanum*, *Nephrops norvegicus* (4), and individuals of *Liocarcinus depurator*, and *Pagurus bernhardus*	SS.SMu.CFiMu	None
ST56	Burrowed mud with scattered pebbles, cobbles and shell	One individual *Pennatula phosphorea*	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST73A	Burrowed mud	Dominated by *Asterias rubens* (54*), Munida* sp. (19), *Urticina eques* (14), *Pagurus bernhardus* (6), and Decapoda sp. (8)	SS.SMu.CFiMu	None
ST73B	Mixed sandy mud with cobbles and pebbles	Dominated by *Asterias rubens* (50), *Munida* sp. (33), Decapoda sp. (4), Rare Hydroids, *Nephrops norvegicus (*5), and Rare *Salmacina dysteri*	SS.SMx.CMx	None
ST6	Burrowed mud	Sparse station with only Pisces sp. (10), Pleuronectiform sp. (1), *Trisopterus luscus* (9), *Scyliorhinus canicula* (1)	SS.SMu.CFiMu	None
ST53	Burrowed mud	Sparse station with only Pisces sp. (4), and *Nephrops norvegicus* (2)	SS.SMu.CFiMu	None
ST20	Burrowed mud	Extremely Sparse station with only *Nephrops norvegicus* (1)	SS.SMu.CFiMu	None
ST49	Fine to medium sands with shell	Rare Porifera sp. On shell with only individual counts of *Cerianthus lloydii ,* Pleuronectiform sp., *Nephrops norvegicus, Goneplax rhomboides, and Pagurus bernhardus*	SS.SMu.CFiMu	None

Station	Substrate	Biota	Biotope	PMFs
ST32	Burrowed mud with shell	Very sparse station with only *Pennatula phosphorea* (2), Pleuronectiform sp. (1), *Pagurus bernhardus* (2) *Merlangius merlangus*(1), and *Tubularia indivisa*, Hydroid sp. On pebbles and boulders.	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST33	Sandy mud with scattered cobbles, pebbles and boulders	Rare outcrop of *Parazoanthus anguicomus* steep rocky outcrop on a sloping soft sediment area with cobbles and pebbles supporting *Munida s*p. (33), Rare *Salmacina dysteri*, *Echinus esculentus* (9), *Urticina eques* (7), *Pennatula phosphorea* (1), and *Virgularia mirabilis* (3) with Rare Hydroid species, *Cerianthus lloydii* (2), and *Metridium senile* (2).	SS.SMu.CFiMu.SpnMeg	Burrowed Mud and *Parazoanthus anguicomus*
ST24	Sandy mud with scattered cobbles, pebbles and boulders	Common *Salmacina dysteri*, *Munida s*p. (47), Encrusting Porifera sp. (R), *Pennatula phosphorea* (3), Rare hydroids, Dendrobranchiata sp. (10), *Limanda limanda* (2), and individuals of species such as *Cancer pagurus*	SS.SMu.CFiMu.SpnMeg	Burrowed Mud
ST14	Gravelly muddy sand with pebbles and shell	Common *Alcyonium digitatum* on loose pebbles and shell, with Rare *Salmacina dysteri*, *Munida s*p. (12), *Spirobranchus triqueter* (O), Hydroid sp. (O), and small numbers of other species such as *Urticina eques* (3)	SS.SMx.CMx	None
ST30	Muddy sand with cobbles, pebbles and shell	Dominated by *Munida s*p. (20), with lesser numbers of other species such as *Echinus esculentus* (8), *Luidia ciliaris* (3), and *Hippasteria phrygiana* (1), with Rare Hydroid sp., *Alcyonium digitatum* and *Salmacina dysteri*	SS.SMx.CMx	None
ST74	Muddy sand with pebbles and shell	Dominated by *Asterias rubens* (44), *Alcyonium digitatum* (O), *Munida s*p. (9), Encrusting Porifera sp. (R), and Rare Hydroid sp.	SS.SMx.CMx	None

Appendix 6. Biotope Photographic inventory of recorded biotopes

Biotope and Sites	Photograph
SS.SBR.SMus.ModT *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata. NH11, NH47, NH21, NH46, NH37, NH50, NH43, NH4, NH44, NH49	
SS.SMx.CMx.OphMx *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment. NH27, NH14, NH29, NH42, NH1, NH41, NH17, NH18	
SS.SMx.CMx Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. NH34, NH8, NH35, NH36, NH33, NH30, NH10, NH23, NH3, NH19, NH28A, NH55, NH53, NH51. NH52	

Biotope and Sites	Photograph
SS.SCS.CCS Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. NH5, NH15, NH45	
SS.SMx.CMx.FluHyd *Flustra foliacea* and *Hydrallmania falcata* on tide swept circalittoral mixed sediment. NH6, NH48, NH32, NH39, NH56, NH16	
CR.MCR.EcCr.FaAlCr Faunal and algal crusts on exposed to moderately wave exposed circalittoral rock, typically occurs on the vertical and upper faces of wave-exposed and moderately wave exposed circalittoral bedrock or boulders subject to mostly moderate to weak tidal streams. NH13	
CR.MCR.EcCr.FaAlCr.Bri Brittlestar bed on faunal and algal encrusted, exposed to moderately wave-exposed circalittoral rock. NH28, NH26	

Biotope and Sites	Photograph
SS.SSa.CMuSa Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. NH58	
SS.SSa.CFiSa Clean fine sands with less than 5% silt/clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20m. NH7, NH57, NH54, NH59	

Appendix 7. Biotope photographic inventory and stations where biotopes were recorded. – Southern Trench

Biotope and Sites	Photograph
SS.SSa Sublittoral sands and muddy sands. Clean medium to fine sands or non-cohesive slightly muddy sands on open coasts, offshore or in estuaries and marine inlets. ST64, ST26	
SS.SMx.CMx Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. ST43, ST65, ST41, ST29, ST23, ST35, ST59, ST71, ST72, ST31, ST46, ST13, ST4, ST42, ST14, ST30, ST74, ST73B	
SS.SCS.CCS Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. ST34	

Biotope and Sites	Photograph
SS.SMx.CMx.FluHyd *Flustra foliacea* and *Hydrallmania falcata* on tide swept circalittoral mixed sediment. ST36	
SS.SMu.CFiMu.SpnMeg Sea pens and burrowing mega fauna in circalittoral fine mud. ST52, ST37, ST8, ST1, ST22, ST19, ST61, ST44, ST68, ST12, ST67, ST9, ST16, ST18, ST21, ST66, ST67, ST10, ST47, ST62, ST69, ST38, ST70, ST56, ST32, ST33, ST24	
SS.SMu.CFiMu Sublittoral muds, occurring below moderate depths of 15-20 m, either on the open coast or in marine inlets such as sea lochs. The sea pens *Virgularia mirabilis* and *Pennatula phosphorea* are characteristic of this biotope complex together with the burrowing anemone *Cerianthus lloydii* and the ophiuroid *Amphiura* spp. ST52A, ST25, ST51, ST11, ST50, ST15, ST45, ST27, ST39, ST57, ST48, ST7, ST58, ST54, ST2, ST6, ST53, ST20, ST49, ST73A	
SS.SSa.CMuSa Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. ST40, ST28, ST17, ST55, ST60	

Biotope and Sites	Photograph
SS.SMu.Csa.Mu Circalittoral, cohesive sandy mud, typically with over 20% silt/clay, generally in water depths of over 10m, with weak or very weak tidal streams. ST3	

Appendix 8. Grab sampling data sheet

Date	Location	Station	Time	Infauna/PSA	Sediment Type	Sediment Colour	Depth of RPD Layer	Depth of Sample	Texture/Presence of Surface features	Photograph

Appendix 9. Noss Head grab sampling field log.

Date	Location	Station	Time	Sample	Sediment type	Sediment Colour	Depth of RPD Layer	Depth of sample	Texture/Surface features	Photograph
04/09/2011	Noss Head	G01	15:05	Benthic	FAILED	n/a	n/a	n/a	n/a	Failed
04/09/2011	Noss Head	G01	15:09	Benthic	FAILED	n/a	n/a	n/a	n/a	572
04/09/2011	Noss Head	G01	15:14	Benthic	FAILED	n/a	n/a	n/a	n/a	Failed
04/09/2011	Noss Head	G02	15:30	Benthic	FAILED	n/a	n/a	n/a	n/a	Failed
04/09/2011	Noss Head	G02	15:34	Benthic	FAILED	n/a	n/a	n/a	n/a	576
04/09/2011	Noss Head	G02	15:38	Benthic	FAILED	n/a	n/a	n/a	n/a	Failed
04/09/2011	Noss Head	G02	15:40	Benthic	FAILED	n/a	n/a	n/a	n/a	577
04/09/2011	Noss Head	G03	15:50	Benthic/PSA	Gravel	Beige	n/a	3		578, 580
04/09/2011	Noss Head	G03	15:58	Benthic	FAILED	n/a	n/a	n/a	n/a	579
04/09/2011	Noss Head	G04	16:05	Benthic	MISSFIRE	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G04	16:07	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G04	16:10	Benthic/PSA	Gravel/Shell	Beige	n/a	3	Shells on surface	
04/09/2011	Noss Head	G04	16:16	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G05	17:20	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G05	17:26	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G05	17:38	Benthic	FAILED	n/a	n/a	n/a	1 live modiolus	586,587
04/09/2011	Noss Head	G05	17:40	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G05	17:44	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G06	17:52	Benthic/PSA	Shell, Gravel	Beige	n/a	8	Large broken shells	588,589
04/09/2011	Noss Head	G07	17:54	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a

Date	Location	Station	Time	Sample	Sediment type	Sediment Colour	Depth of RPD Layer	Depth of sample	Texture/Surface features	Photograph
04/09/2011	Noss Head	G07	18:14	Benthic	Shell, Gravel	Beige	n/a	2	Sponge, Shell	596-598
04/09/2011	Noss Head	G08	18:25	Benthic/PSA	Shell, Gravel	Beige	n/a	6	Sponge, Shell	600,601
04/09/2011	Noss Head	G09	18:35	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G09	18:36	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
04/09/2011	Noss Head	G09	18:40	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
05/09/2011	Noss Head	G10	14:38	Benthic/PSA	Sand	Beige	n/a	10cm	None	606, 609, 610
05/09/2011	Noss Head	G11	14:46	Benthic/PSA	Gravel and shell	Beige	n/a	8cm	Broken shell	611-614
05/09/2011	Noss Head	G12	14:57	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
05/09/2011	Noss Head	G12	15:00	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a
05/09/2011	Noss Head	G12	15:03	Benthic	FAILED	n/a	n/a	n/a	n/a	n/a

Appendix 10. Southern Trench Grab sampling Field log.

Date	Location	Station	Time (bst)	Sample	Sediment type	Sediment Colour	Depth of RPD Layer	Depth of sample	Texture/Surface features	Photograph
06.09.11	Southern Trench	G01	09:25	Benthic and PSA	Muddy Sand	Dark Grey	n/a	7.5	n/a	615, 616
06.09.11	Southern Trench	G02	10:55	Benthic and PSA	Muddy Sand	Dark Grey	n/a	7.5	n/a	617,618
06.09.11	Southern Trench	G03	15:21	Benthic and PSA	Mud	Dark Green/Brown	n/a	13.8	n/a	625-627
07.09.11	Southern Trench	G04	13:48	Benthic and PSA	Sandy mud	Dark brown	2	7.4	n/a	631-633
08.09.11	Southern Trench	G05	09:52	Benthic and PSA	Gravelly sand	Reddish Brown	n/a	9.5	n/a	634-636
08.09.11	Southern Trench	G06	12:32	Benthic and PSA	Sandy mud	Dark Brown	n/a	5	Shell	n/a
08.09.11	Southern Trench	G07	15:45	Not enough in Grab	n/a	n/a	n/a	n/a	n/a	n/a
08.09.11	Southern Trench	G07	16:00	Benthic and PSA	Sandy mud	Dark brown	n/a	6	Worm tubes	645-647
08.09.11	Southern Trench	G08	17:32	MISSFIRE	n/a	n/a	n/a	n/a	n/a	n/a
08.09.11	Southern Trench	G08	17:37	Not enough in Grab	n/a	n/a	n/a	n/a	n/a	n/a

Date	Location	Station	Time (bst)	Sample	Sediment type	Sediment Colour	Depth of RPD Layer	Depth of sample	Texture/Surface features	Photograph
08.09.11	Southern Trench	G08	17:44	Benthic and PSA	Sandy mud	Dark brown	n/a	6.5	n/a	n/a
09.09.11	Southern Trench	G09	12:47	Not enough in Grab	n/a	n/a	n/a	n/a	n/a	n/a
09.09.11	Southern Trench	G09	13:00	Benthic and PSA	Sandy mud	Dark brown	n/a	7.5	n/a	653, 654
09.09.11	Southern Trench	G10	15:15	Benthic and PSA	Mud	Greenish Brown	n/a	7.8	n/a	655-657
09.09.11	Southern Trench	G11	16:35	Benthic and PSA	Mud	Dark brown	n/a	7.9	n/a	n/a
09.09.11	Southern Trench	G12	19:02	Stones in teeth	n/a	n/a	n/a	n/a	n/a	n/a
09.09.11	Southern Trench	G12	19:05	Benthic and PSA	Sand	Dark brown	n/a	6.8	n/a	n/a
10.09.11	Southern Trench	G13	09:50	Benthic and PSA	Gravelly sand	Dark brown	2	5	n/a	666-668
10.09.11	Southern Trench	G14	10:51	MISSFIRE	n/a	n/a	n/a	n/a	n/a	n/a
10.09.11	Southern Trench	G14	10:57	Benthic and PSA	Mud	Dark Green/Brown	n/a	14.5	n/a	n/a
10.09.11	Southern Trench	G15	12:47	Benthic and PSA	Mud	Dark Green/Brown	n/a	11	n/a	n/a

Date	Location	Station	Time (bst)	Sample	Sediment type	Sediment Colour	Depth of RPD Layer	Depth of sample	Texture/Surface features	Photograph
10.09.11	Southern Trench	G16	14:51	Benthic and PSA	Mud	Dark Green/Brown	n/a	14	n/a	n/a
10.09.11	Southern Trench	G17	17:25	Benthic and PSA	Sandy mud	Dark brown	n/a	8	n/a	n/a
11.09.11	Southern Trench	G18	10:17	Benthic and PSA	Mud	Greenish Brown	2	12	n/a	n/a
11.09.11	Southern Trench	G19	13:57	Benthic and PSA	Sandy mud	Greenish Brown	2	7	n/a	n/a
11.09.11	Southern Trench	G20	15:55	Benthic and PSA	Sandy mud	Dark brown	2	7.5	n/a	n/a

Appendix 11. Grab sample infauna data Noss Head and Southern Trench

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	*Astrorhiza limicola*								33	1		8				10		3		1	1		1		16		2	
A	*Pelosina arborescens*																	2	1									
D0632	*Cerianthus lloydii*											4			1	6	1	1		2					2			2
D0766	*Edwardsia* cf. *claparedii*								2			1	5			5	5	4	2	12	3				6			
D618	*Virgularia mirabilis*												1															
D623	*Pennatula phosphorea*																						2					
D662	*Actiniaria indet.*		1					1																				
D783	*Caryophyllia smithii*							1																				
F	*Flatworm indet*	1	1		3	3	7				1															1		
G001	*Nemetera indet.*	6	2	14	7	16	6	24	4		1	3		6	7	2	1	9	3	2	7	1	5		5	2	1	9
G0034	*Tubulanus polymorphus*													2					2		1							1
G0039	*Cerebratulus* sp.								1								1						1				2	1
G007	*Cephalothricidae* indet.															1												1
G059	*Micrura indet.*										1																	
G109	*Oerstedia dorsalis*	4				2		1								1												
G117	***Tetrastemma* sp.**													1														
HD	*Nematoda*	24	30			78	44	188	2				1								1		1					
L29	*Spadella cephaloptera*	2						5																				
N01	*Sipuncula indet.*	1	2	2		3		1								1				1					1			
N14	*Golfingia elongata*																			1								

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
N17	*Golfingia vulgaris*								1									2										
N25	*Nephasoma minutum*		1					7							5	2												1
N28	*Thysanocardia procera*								1																			
N34	*Phascolion strombus*					1		1						1													1	
P0006	*Chrysopetalum*	1	2																									
P0009	*Dysponetus*	1				2		1																				
P0015	*Pisione remota*			1			7	3					13															
P0025	Polynoid indet.	3	7	13	15	4		8							**14**	7		4	1		6							
P0027	*Acanthicolepis asperrima*	frag.																										
P0032	*Adyte pellucida*					1		1													1							
P0044	***Enipo kinbergi***																	frag.										
P0049	*Gattyana cirrosa*															1		1	1									
P0050	*Malmgrenia indet.*							6							1						1						1	
P0059	*Harmothoe fragilis*					frag.		frag.																				
P0066	*Malmgrenia ljungmanni*		3																		4							
P0068	*Malmgrenia marphysae*																				1							
P0070	*Malmgrenia mcintoshi*	1	4	4		3																						
P0082	*Lepidonotus squamatus*				2													1										
P0092	*Pholoe baltica*			1	2	1		2	5	1		1			10	1		6	1		9		3		1		2	3
P0093	*Pholoe pallida*										2											1		3	1		2	
P0094	*Pholoe inornata*														1			1										
P0109	*Sthenelais limicola*									1				1		1	1		1						1			

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0114	*Phyllodocidae*	2																			1							
P0118	*Eteone longa*																				1							
P0122	*Hesionura elongata*						4						3															
P0130	*Mystides caeca*	1		3		3		15																				
P0136	*Pseudomytides limbata*												4								1							
P0146	*Phyllodoce rosea*																							1				1
P0155	*Eulalia mustela*			1		1		4					1		**2**													
P0161	*Eulalia viridis*					1																						
P0163	*Eumida* sp. *indet*				2	3								**1**	3			5			3							3
P0165	*Eumida ockelmanni*								2																			
P0167	*Eumida sanguinea*	6						3								2									1			
P0171	*Nereiphylla rubiginosa*														1			1										
P0195	*Lacydonia miranda*	1	11	3		6		12																				
P0255	*Glycera juv. indet.*								1																			
P0256	*Glycera alba*									1							**1**											3
P0260	*Glycera lapidum*	5	12	17		7	3	35				1		1	5					4	6							
P0262	*Glycera oxycephala*													1														
P0263	*Glycera rouxii*										2	2				2		2	2			4	2	1	1	2		
P0268	*Glycinde nordmanni*												1		2			2					2		1			1
P0271	*Goniada maculata*								2		1										1	1	3				1	4
P0282	*Ephesiella abyssorum*			1				3																				
P0285	*Sphaerodoropsis indet.*			1																								

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0291	*Sphaerodorum gracilis*					1		2				1			8													
P0294	*Hesionidae juv. indet.*	1		4														3							6			
P0300	*Gyptis propinqua*	87	2	29		67		2																				
P0303	*Hesiospina similis*	3	11	5		5		8																				
P0305	*Kefersteinia cirrata*	7	2	7				18					1			1					3							
P0311	*Nereimyra punctata*			1	3	2									29										1			3
P0313	*Ophiodromus flexuosus*																							1				
P0317	*Podarke pallida*							1																				
P0319	*Podarkeopsis capensis*																								1			
P0340	*Glyphohesione klatti*																	1					1					
P0349	*Syllis cornuta*							4						4	4	**1**		4		**1**								
P0355	*Eurysyllis tuberculata*	7		11		6		17																				
P0358	*Syllis indet.*				1			1							1													
P0358	*Syllis sp. E*			12		3		8																				
P0358	*Syllis sp. H*			15		1		8					1															
P0362	*Trypanosyllis coeliaca*	7	6	21		21		34																				
P0365	*Syllis armillaris*			2	31										2													
P0371	*Syllis variegata*							1																				
P0375	*Amblyosyllis formosa*	2		1				2																				
P0377	*Dioplosyllis cirrosa*						2	2																				
P0379	*Eusyllis assimilis*	1		4		1	1	5																				
P0380	*Eusyllis blomstrandi*	4		4	16	6		1										2										

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0387	*Odontosyllis fulgurans*			4		2		8										1										
P0388	*Odontosyllis gibba*	61	27	49		32		35																				
P0391	*Opisthodonta pterochaeta*			3			1	9																				
P0403	*Streptosyllis bidentata*					1		12																				
P0406	***Syllides cf. japonica***			1		5		1							2			2			1							
P0421	*Exogone hebes*			1								1	4	1				1			1				2			
P0422	*Exogone naidina*							3	4					2	12	2		1			1							6
P0423	*Exogone verugera*											2		3	3	1					1							13
P0425	*Sphaerosyllis bulbosa*	24	47	112		33		201													1							
P0426	*Sphaerosyllis erinaceus*			1																								
P0430	*Sphaerosyllis taylori*	1		2											13						4							2
P0431	*Sphaerosyllis tetralix*	1	1	12	1			29																				
P0434	*Autolytus indet*	5		5	5	4		4							4						2							
P0435	*Autolytus alexandri*	1			5	3		2																				
P0458	*Nereididae juv. indet*																								1			
P0458	*Rullierinereis sp. A*		1																									
P0474	*Nereis elitoralis*							1							1			1										
P0476	*Nereis pelagica*				**1**										10	1												
P0478	***Nereis zonata***																								**3**			
P0493	*Aglaophamus rubella*			1									2			**1**												
P0494	*Nephtys juv. indet.*															**1**	3											

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0496	*Nephtys caeca*																			1								
P0498	*Nephtys cirrosa*											3	1							1								
P0499	*Nephtys hombergii*								1	1						2	1		2				1		3			
P0502	*Nephtys kersivalensis*									1	1	1							3				1				3	
P0503	*Nephtys longosetosa*									1																		
P0526	*Euphrosine borealis*		7																									
P0542	*Hyalinoecia tubicola*															1												
P0544	*Nothria britannica*								1					1														
P0577	*Lumbrineris fragilis*	1		2				1																				
P0579	*Lumbrineris gracilis*		1					1	6			10			6	4	2	2	1	1	21		1		17	1	1	17
P0580	*Lumbrineris hibernica*										4													3		3		
P0591	*Drilonereis filum*																	frag.										
P0597	*Notocirrus scoticus*																										1	
P0613	*Ophryotrocha indet.*																									1		
P0638	*Protodorvillea kefersteini*							14																				
P0665	*Orbinia sertulata*										1															1		
P0672	*Scoloplos armiger*								14		1	2		1	1	3	1	1	2				1				1	6
P0684	*Aricidea catherinae*														1													
P0685	*Aricidea cerrutii*							6										1										1
P0686	***Aricidea laubieri***																	**1**					**2**					
P0690	*Cirrophorus branchiatus*																											1

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0699	*Paradoneis lyra*		1						5					1		1		4										4
P0712	*Apistobranchus tullbergi*																						1					1
P0718	*Poecilochaetus serpens*								1											1			2					1
P0720	*Spionidae indet.*							2								1												
P0723	*Aonides paucibranchiata*		4	11	1	12		11					1			2					1							
P0733	*Laonice bahusiensis*	2		3		1		2			1				1			2			4		1	4			1	
P0747	*Minuspio cirrifera*								4		4					2		3	2	1	4		2	2	2		4	1
P0748	*Polydora indet.*	1			8	1		1	1							2			1									
P0751	*Polydora caulleryi*				1																							
P0762	*Polydora socialis*				2																							
P0764	*Prionospio dubia*									1	2								5			2	1	7	1	15	4	
P0765	*Prionospio fallax*					6											1		1				2	1		3		
P0766	*Prionosio banyulensis*	1	2	6				12	2						**34**						**21**		1					2
P0773	*Pseudopolydora paucibranchiata*									4	1							1			1	1		1		1		1
P0774	*Pseudopolydora pulchra*															1												
P0779	*Scolelepis bonnieri*									1																		
P0784	*Scolelepis sp. A*																									1		
P0784	***Scolelepis sp. B***												**5**															
P0788	*Spio armata*												3															
P0794	*Spiophanes bombyx*								8			5	3			1	1			1							1	

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0796	*Spiophanes kroyeri*										5			2	8	4		4		1	2	2	2	15	4	6	1	3
P0804	*Magelona alleni*								3	1								1					5			1	1	
P0811	*Chaetopterus sp.*			1					1											1						1		
P0822	*Cirratulidae indet.*			1											2													
P0823	*Aphelochaeta sp. A*											1										1						
P0832	*Chaetozone christiei*									1																		
P0834	*Chaetozone setosa*								5	1	5					1			2				3	1	1	2	1	1
P0835	*Cirratulus sp.*														1													
P0840	*Dodecaceria sp.*				1																							
P0846	*Tharyx killariensis*											1		1				1					2			1		2
P0878	*Diplocirrus glaucus*								2		18	1				2	1	14	2			4	7	2	2	2	16	
P0881	*Flabelligera affinis*			1		1		1													1							
P0890	*Macrochaeta sp.*		1	5		3		14					1															
P0891	*Macrochaeta clavicornis*			3																	1							
P0907	*Capitella capitata*														2													
P0919	*Mediomastus fragilis*					1			2						5	4		4	1	1	7		1	4				
P0920	*Notomastus sp.*		2			3		3										1	1	2	1							1
P0925	*Peresiella clymenoides*								1			1				2		3	3		11		3			4		5
P0927	*Pseudonotomastus southerni*			2																			1					
P0938	*Maldanidae indet.*													1														
P0944	*Praxillura longissima*																	1	1									

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P0955	*Clymenura indet.*														1													1
P0955	*Clymenura tricirrata*					2			2	2	1			2			2	3				1						1
P0960	*Euclymene indet.*								2						1					1								
P0960	*Euclymene sp. A*																						5					
P0971	*Praxillella affinis*													1								6		6		3		
P0972	*Praxillella gracilis*																							3				
P0982	*Nicomache trispinata*													3														
P0984	*Notoproctus sp.*	2	4	3		1		2						9														
P0990	*Rhodine gracilior*																	frag.	1				**1**		1			
P0999	*Ophelia borealis*											1		1														
P1014	*Ophelina acuminata*										2	1										2						
P1020	*Scalibregmatidae sp. 1*																			1								
P1026	*Scalibregma celticum*			4		1		1																				
P1027	*Scalibregma inflatum*									1	2	1				1		3			16	2		1	8	1	1	2
P1031	*Nerillidae indet.*						1																					
P1062	*Polygordius indet.*			2		2	7	11																				
P1069	*Protodilus indet.*							3																				
P1083	*Protodriloides chaetifer*						1																					
P1088	*Saccocirrus papillocercus*						2																					
P1093	*Galathowenia oculata*								6	7	2	1		32	13	27	6	8	55	1		3	79	4	21	5	76	
P1094	*Myriochele sp.*													13														

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P1095	*Myriochele danielsseni*													13		4	1	1									1	1
P1098	*Owenia fusiformis*								17	4		14	2	1	2	14	7	4	1	6			4		9		4	4
P1102	*Amphictene auricoma*																	2			3							
P1107	*Lagis koreni*								10	2		2			1		2		1								5	
P1117	*Sabellaria spinulosa*														198	4									1			2
P1118	*Ampharetidae indet.*													2				5										
P1134	*Ampharete baltica*																										5	
P1135	*Ampharete falcata*								1	2	1						4	3	6			2	11	1	9		6	
P1139	*Ampharete lindstroemi*														4	1		6	4	1	2				3		4	
P1142	*Amphicteis gunneri*														1			1					1		1			
P1147	*Anobothrus gracilis*								1			2		2	1	11	2	7	3	1	2		6		7		17	4
P1160	*Sabellides octocirrata*														1			1							1			1
P1173	*Octobranchus floriceps*		1																									
P1175	*Terebellides stroemi*										1				2			6	1		8		4		5		3	
P1177	*Trichobranchus glacialis*				1	4		1							5			3			4							1
P1179	*Terebellidae indet.*			2		1		1	1						4			1										
P1190	*Eupolymnia nesidensis*	4	9	1				3																				
P1195	*Lanice conchilega*							3		1						1		1	1	1			1				1	
P1217	*Pista cristata*																				1							
P1229	*Amaeana trilobata*									1																		
P1233	*Lysilla loveni*								2	1								2					1				1	
P1234	*Lysilla nivea*			3				2													1							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P1235	*Polycirrus indet.*		4			6		8																				
P1242	*Polycirrus medusa*			11									3	2														
P1243	*Polycirrus norvegicus*	3			2							1									1							
P1244	*Polycirrus plumosus*																		**2**									
P1249	*Parathelepus collaris*							5																				
P1254	*Thelepus cincinnatus*															1		5										
P1257	*Sabellidae juv. indet.*	9		10		6	7	25																				
P1267	*Chone duneri*			2		1		4																				
P1269	*Chone filicaudata*	5	11	11		9		36																				
P1271	*Demonax sp.*																								1			
P1280	*Euchone rubrocincta*																				3							
P1281	*Euchone southerni*	2	1	1		4		3													3							
P1282	*Fabricia sp.*	1				1																						
P1289	*Jasmineira caudata*														1													
P1290	*Jasmineira elegans*	1			2			1																				
P1316	*Pseudopotamilla reniformis*				1			1																				
P1318	*Sabella discifera*							1																				
P1320	*Sabella pavonina*																	1										1
P1327	*Chitinopoma serrula*				1																							
P1334	*Hydroides norvegica*	3	2			2									1						3							
P1341	*Pomatoceros triqueter*	13	1	4	10	6		1													8							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P1343	*Serpula vermicularis*	1			1			1							4	1					16				2			
P1501	*Enchytraeidae indet.*		1	10				16																				
Q33	*Callipallene brevirostris*			3		3		1										1										
Q44	*Anoplodactylus petiolatus*															1												
Q56	*Halacaridae*	6				1	5	7																				
R0022	*Scalpellum scalpellum*																								1			
R0041	*Verucca stroemia*				3										10										8			
R0785	*Harpacticoida*	13				5	4	18																				
R2412	*Ostracoda*		4			2		2						1	7													
S0092	*Heteromysis formosa*					1		1																				
S0098	*Gammaridea indet.*	1		16	2		1	1							1	1									2			
S0102	*Apherusa bispinosa*	1	1		2																							
S0124	*Monoculodes borealis*																				2							
S0131	*Perioculodes longimanus*																1											
S0138	*Synchelidium maculatum*			1					1											1								
S0140	*Westwoodilla caecula*								3	1						1	1			1								
S0156	*Amphilocus indet.*				1			1																				
S0158	*Amphilochus manudens*	10				24																						
S0164	*Gitana sarsi*					3																						
S0177	*Leucothoe incisa*			1					1																			
S0178	*Leucothoe liljeborgi*																	1										
S0180	*Leucothoe spinicarpa*				7																							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
S0186	*Cressa dubia*				1										5													
S0207	*Stenothoe sp.*				2	1									2													
S0213	*Stenothoe marina*														1										1			
S0248	*Urothoe elegans*				1				1	2		7			1	1	1	1	1			1		1	1		1	21
S0254	*Harpinia antennaria*									2	2						1					1		1			2	
S0255	*Harpinia crenulata*															1												
S0265	*Parametaphoxus fultoni*	2	3	1		5		6																				
S0271	*Lysianassidae*	1			1	1									1													
S0274	*Acidotomum nodifera*									2									1				1					
S0296	*Hippomedon denticulatus*								1					1		2			1							1		
S0301	*Lepidepecreum longicorne*								1					1														
S0305	*Lysianassa plumosa*							1																				
S0351	*Austrosyrrhoe fimbriatus*	1	1	1		2		5																				
S0360	*Argissa hamatipes*							1																				
S0382	*Iphimedia obesa*				4																							
S0384	*Iphimedia spatula*			1		1																						
S0396	*Liljeborgia kinahani*	1	1	1		3		13																				
S0399	*Listriella mollis*					3																						
S0406	*Nicippe tumida*																							3				
S0413	*Atylus vedlomensis*	5	3	2		3		3				1								1	3							2
S0418	*Guernea coalita*	1		4				2																				
S0419	*Triteata sp.*				1																							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
S0423	*Ampelisca indet.*											1			1													2
S0427	*Ampelisca brevicornis*									1									1	2								
S0438	*Ampelisca spinipes*														3													
S0440	*Ampelisca tenuicornis*								11					1			2			1					1	1	1	22
S0442	*Ampelisca typica*																			3								1
S0493	*Melphidipiella macra*								1																			
S0502	*Ceradocus semiserratus*	1	1	1		3		6																				
S0503	*Cheirocratus indet.*			2												1		1			2							
S0518	*Maera loveni*																							3				
S0519	*Maera othonis*	1				1									4			1			4							
S0537	*Isaeidae indet.*					8		1																				
S0539	*Gammaropsis cornuta*	3		2				1																				
S0541	*Gammaropsis maculata*														20						2				1			
S0542	*Gammaropsis nitida*				1																							
S0543	*Gammaropsis palmata*														3													
S0550	*Microprotopus maculatus*				1																							
S0552	*Photis longicaudata*								3									2		2					3			9
S0561	*Erichthonius indet.*				1																							
S0583	*Autonoe longipes*														1			1								1		
S0588	*Leptocheirus hirsutimanus*		3	1		2																						
S0589	*Leptocheirus pectinatus*	4				7		2																				
S0618	*Siphonoecetes kroyeranus*											5																

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
S0629	*Dyopedos porrectus*				2	1																			1			
S0646	*Caprella linearis*				55	2																						
S0651	*Pariambus typicus*																3											
S0657	*Phtisica marina*																						2		1		1	
S0659	*Pseudoprotella phasma*				6										1													
S0796	*Gnathia oxyuraea*	11	3	13		66		14								5												2
S0853	*Eurydice inermis*	3	23	2		1		3				1	1															
S0892	*Janira maculosa*	9			16	7									2													
S0896	*Microcharon harrisi*						19	2																				
S0911	*Paramunna bilobata*							4																				
S0925	*Eurycope sp.*	2																										
S0951	*Arcturella dilatata*								1																1			
S1118	*Araphura brevimana*																						1					
S1132	*Leptognathia breviremis*	11	14	3		12		13																				
S1135	*Leptognathia paramanca*		1																									
S1140	*Pseudoparatanais batei*			**1**																								
S1142	*Tanaopsis gracilis*								11											1								
S1206	*Eudorella emarginata*																							1		2		
S1208	*Eudorella truncatula*								1	1	1																1	1
S1224	*Cumella pygmaea*							2																				
S1228	*Nannastacus unguiculatus*		1					1																				
S1244	*Diastylidae indet.*																					1			1			

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
S1251	*Diastylis laevis*								6								4											2
S1255	*Diastylis tumida*														11	1												
S1257	*Diastyloides biplicata*								2	4					3		2	1	1				1				2	
S1276	*Decapoda juv. indet.*	3	1																									
S1276	*Decapoda indet.*														1													
S1337	*Caridion indet.*								1																			
S1345	*Eualus pusiolus*	8		2	19	3		1	1																			
S1367	*Processa nouveli*								1		1															2		
S1374	*Pandalina brevirostris*														2													
S1388	*Philoceras fasciatus*						1																					
S1409	*Calocaris macandreae*										1																	
S1415	*Callianassa subterranea*		1								2							1	1			1	1	2	1	2		
S1419	*Upogebia deltaura*																				4							
S1445	*Paguridae indet.*																				2							
S1448	*Anapagurus hyndmanni*																				2							
S1449	*Anapagurus laevis*															1							3		1			
S1460	*Pagurus cuanensis*																				1							
S1463	*Pagurus pubescens*				2																							
S1470	*Galathea sp.*																				3				1			
S1472	*Galathea intermedia*		1	2	5			1							1						9					1		
S1474	*Galathea nexa*					3			1																			
S1478	*Munida rugosa*																				1							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
S1482	*Pisidia longicornis*				10																1							
S1518	*Hyas araneus*														2													
S1520	*Inachinae indet.*				2																							
S1531	*Macropodia linaresi*				1																							
S1555	*Atelecyclus rotundatus*								1						1			1										
S1577	*Liocarcinus indet.*																											1
S1606	*Goneplax rhomboides*																							1				
W0006	*Scutopus ventrolineatus*							1														2		2				
W0009	*Chaetoderma nitidulum*								1								1		1		1	1	2				1	
W0030	*Neomenia carinata*																								1			
W0053	*Leptochiton asellus*	2	1	6		3		5							1					1	11							
W0161	*Gibbula tumida*	3		4				10																				
W0172	*Jujubinus miliaris*														1													
W0181	*Calliostoma formosum*														1													
W0204	*Diskoleps pusilla*		1					6																				
W0270	*Turritella communis*								1																		1	
W0344	*Alvania punctura*														2													
W0368	*Onoba aculeus*														2													
W0418	*Caecum glabrum*		5					13																				
W0430	*Aporrhais pespelecani*								1																			
W0465	*Erato voluta*			1																								
W0476	*Velutina sp.*					1																						

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
W0489	*Polinices fuscus*																	1										
W0490	*Polinices montagui*								1	1					2	2				1			1		4			
W0491	*Polinices pulchellus*			2						1		1	1		1			1	1	1						1		
W0603	*Eulima bilineata*		1																									
W0669	*Vitreolina philippi*																											1
W0715	*Colus gracilis*			1																								
W0795	*Mangelia juv.indet.*			1																								
W0908	*Odostomia indet.*																								1			
W0922	*Brachystomia eulimoides*				1																							
W0931	*Chrysallida sp.*																	1										
W0985	*Turbonilla crenata*																		1									
W1002	*Cephalaspidea indet.*																	1										
W1023	*Roxania utriculus*																								1			1
W1028	*Cylichna cylindracea*		1						2	1					1		1	1				1		1		2		1
W1045	*Philine scabra*									1													1				1	
W1077	*Retusa obtusa*																	1										
W1243	*Nudibranchia indet.*	6		7	4	12		14													2							
W1514	*Pulsellum affine*																		3								1	
W1519	*Antalis antalis*								6	5		2		1	3	5	3	2	2	2	1		5		5		2	
W1569	*Nucula nitidosa*										1				1				1				1					1
W1571	*Nucula sulcata*																							2				
W1688	*Glycymeris glycymeris*		4	3				2																				
W1695	*Mytilus edulis*				9																							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
W1702	*Modiolus modiolus*	8	10	3		2		11						1	6	1												
W1715	*Crenella decussata*		1					7																				
W1743	*Limaria loscombi*			2			1																					
W1746	*Limatula subauriculata*	1	4			2		1																				
W1768	*Pectinidae juv.*														1			1							1			
W1771	*Pecten maximus*																											1
W1786	*Palliolum tigerinum*	1		1				1																				
W1805	*Anomiidae*	4	1	2	4	2		2																				
W1827	*Myrtea spinifera*																	1					1	1			2	
W1829	*Lucinoma borealis*																1		1								1	
W1837	*Thyasira flexuosa*								3	3						1	1					1	1			5		
W1866	*Galeommatacea indet.*		2																							**1**		
W1875	*Kellia suborbiculata*				1																							
W1892	*Montacuta substriata*															1												
W1902	*Tellimya ferruginosa*																	2	1							1		
W1906	*Mysella bidentata*				1			1	4									10										
W1925	*Astarte sulcata*	1	2																									
W1929	*Goodallia triangularis*		6	10		1		138																				
W1936	*Goodallia montagui*		1	2																	1							
W1943	*Acanthocardia echinata*								3	2	1						3		1								2	
W1951	*Parvicardium ovale*								1						1													
W1975	*Spisula elliptica*	1						2						1														

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
W2006	*Phaxas pellucidus*									2								1										3
W2015	*Arcopagia crassa*					1																						
W2048	*Gari costulata*					1																						
W2051	*Gari fervensis*							1	1			2		1		1		2	1									
W2061	*Abra nitida*										8						2	2	4			15	3	14		9	5	
W2062	*Abra prismatica*									5		1		5		2	2		3	1			1		5			
W2072	*Arctica islandica*								1							1	1						1	1				
W2091	*Venus casina*		1			2		1																				
W2095	*Gouldia minima*		1	1																								
W2098	*Chamelea striatula*								1	1	1																	
W2100	*Clausinella fasciata*			1																								
W2104	*Timoclea ovata*			1					1			1								2		1	1					
W2113	*Tapes rhomboides*					1		1																				
W2128	*Dosinia lupinus*									1										1					1			
W2139	*Mysia undata*																										1	
W2141	*Myacea juv. indet.*							1																				
W2157	*Corbula gibba*																		1									
W2166	*Hiatella arctica*															1												
W2231	*Thracia phaseolina*																											
W2233	*Thracia villosiuscula*		2						1					1		2				4								
W2239	*Cochlodesma praetenue*								1								**1**											
ZA1	*Phoronis*								3	4					1	3	4	1	2	2			11		4			
ZB026	*Astropecten irregularis*		1	2																	1							

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ZB075	*Crossaster papposus*			1																								
ZB124	*Ophiothrix fragilis*	2		3	13	3		7																				
ZB147	*Ophiopholis aculeata*	1			2	14									10													
ZB152	*Amphiura chiajei*										3											7	1	12				
ZB154	*Amphiura filiformis*								8	16	3	22			12	6	7	16	7				15	3	6		20	3
ZB161	*Amphipholis squamata*	26	17	45		48	1	79													10							
ZB167	*Ophiura affinis*								3	5		3					1	2				3						2
ZB168	*Ophiura albida*								2			3		1		4	1	4			2		2		4			
ZB193	*Psammechinus miliaris*			1				**1**													1				1			
ZB198	***Echinus esculentus***							**1**																				
ZB212	*Echinocyamus pusillus*			1				2	2	2	1	9	4	19	1	1	1	3		7	5		3		1			
ZB219	*Spatangus purpureus*															1												
ZB222	*Echinocardium juv. indet.*								**4**	1				1							2		1		4		1	
ZB223	*Echinocardium cordatum*								**52**	65		10		10	1	5	7	7	5	2	2						1	
ZB224	*Echinocardium flavescens*								2					1			4			1			10				4	1
ZB228	*Brissopsis lyrifera*																									3	1	
ZB229	*Holothuroidea juv. indet.*							1																				
ZB257	*Pseudothyone raphanus*																			1								
ZB262	*Thyone fusus*														2			1							1			1
ZB291	*Leptosynapta indet.*								1		1					**1**	1							1			2	1
ZB292	***Leptosynapta bergensis***																									**1**		
ZB299	*Labidoplax buskii*							2		**2**				**2**				8	3				6				11	

MCS Code	Species	NOSS HEAD							SOUTHERN TRENCH																			
		3	4	6	7	8	10	11	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ZC18	*Saccoglossus indet.*																	1										1
ZD	*Tunicata*					1		1																				
ZD	*Compound ascidian*	P	P	P				P																				
ZD084	*Ascidiella aspersa*				1																							
ZD110	*Polycarpa indet.*			1																								
ZD135	*Boltenia echinata*				1																							
ZD145	*Molgulidae*													1														
ZD159	*Eugyra arenosa*							2		1																		
ZG	*Pisces*			1					1						1													
	Branchiostoma lanceolatum						1																					
EPIFAUNA ID UNCERTAIN																												
C053	*Leucosolenia*				P																							
C131	*Scypha*		P	P		P																						
C475	*Cliona*							P						P							P				P			
D597	*Alcyonium digitatum*														P													
Y013	*Crisia*							P																				
Y065	*Disporella*																								P			
Y076	*Alcyonidium diaphanum*															P												
Y081	*Alcyonidium parasiticum*														P													
Y299	*Cellaria*																											P
C001	*Porifera*		P	P	P									P														
D	*Hydroidea*				P																P				P			P
Y	*Bryozoa*	P			P	P		P													P							P

Appendix 12. Noss Head Particle Size Analysis

Sieved Fraction (µm)	Wentworth Class	NHG06	NHGO8	NHG10	NHG04	NHG03	NHG11
>4000	Gravel	12.1	34.9	0.3	16.1	7.8	4.2
2000 - 4000	Very fine gravel	18.5	20.6	6.2	29.2	18.2	14.6
1000 - 2000	Very coarse sand	25.1	19.1	45.2	25.9	41.5	30.6
500 - 1000	Coarse sand	24.4	13.6	45.4	13.8	26.2	34.2
250 - 500	Medium sand	16.0	6.7	1.9	8.9	2.9	13.0
125 - 250	Fine sand	1.4	1.9	0.4	1.8	0.5	1.2
63 - 125	Very fine sand	0.5	0.6	0.1	0.7	0.3	0.4
<63	Silt & Clay	2.0	2.6	0.5	3.5	2.6	1.7
MDØ (median diameter in phi)		-0.70	-1.80	-0.52	-1.32	-0.90	-0.50
MD (median diameter in mm)		1.62	3.48	1.43	2.50	1.87	1.41
QDØ (quartile deviation in phi)		1.15	N/A	0.49	0.95	0.62	0.73
QD (quartile deviation in mm)		0.45	N/A	0.71	0.52	0.65	0.60
Error in Sieving (%)		0.97	-2.50	0.23	0.95	0.28	-0.08

Appendix 13. Southern Trench Particle Size Analysis

Sieved Fraction (µm)	Wentworth Class	ST G3	STG 18	STG 19	STG 2	STG 4	STG 9	STG 7	STG 5	STG 6	STG 8	STG 1	STG 11	STG 13	STG 17	STG 10	STG 20	STG 12	STG 14	STG 16	STG 15
>4000	Gravel	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.9	0.2	1.0	0.4	0.0	8.0	0.2	0.0	2.5	1.7	0.0	0.0	0.3
2000 - 4000	Very fine gravel	0.0	0.0	0.0	0.0	0.3	0.0	1.0	2.7	0.9	0.4	0.3	0.0	9.0	0.2	0.1	3.8	1.8	0.0	0.1	0.0
1000 - 2000	Very coarse sand	0.0	0.1	0.0	0.0	0.5	0.1	1.5	5.5	0.9	0.8	0.2	0.1	18.7	0.7	0.6	4.3	4.9	0.0	1.8	0.5
500 - 1000	Coarse sand	0.3	1.9	0.4	0.6	2.1	0.9	6.6	22.0	1.8	4.0	2.1	2.0	16.4	7.5	4.2	8.0	9.5	0.2	2.1	5.2
250 - 500	Medium sand	0.9	4.3	5.7	14.3	22.1	5.2	29.5	58.8	24.3	23.2	22.6	17.7	10.0	43.0	26.9	28.6	45.9	1.5	1.5	34.2
125 - 250	Fine sand	5.8	14.7	55.9	66.2	63.9	51.5	41.9	8.7	65.2	54.9	57.0	50.5	18.9	34.2	40.8	38.8	29.7	12.2	7.1	33.4
63 - 125	Very fine sand	51.4	33.6	24.7	9.6	6.4	33.2	10.3	0.2	2.0	10.2	12.7	17.2	8.0	3.9	12.7	9.0	2.0	45.5	31.1	8.9
<63	Silt & Clay	41.6	45.5	13.2	9.3	4.7	9.1	8.9	1.2	4.7	5.6	4.7	12.5	11.0	10.3	14.7	4.8	4.6	40.5	56.4	17.5
MDØ (median diameter in phi)		3.34	3.40	2.25	2.01	1.90	2.35	1.76	0.84	1.85	1.90	1.91	2.09	0.35	2.48	1.92	1.58	1.20	3.30	3.65	1.76
MD (median diameter in mm)		0.10	0.09	0.21	0.25	0.27	0.20	0.30	0.56	0.28	0.27	0.27	0.23	0.78	0.18	0.26	0.33	0.44	0.10	0.08	0.30
QDØ (quartile deviation in phi)		0.50	0.66	0.51	0.34	0.37	0.53	0.60	0.44	0.38	0.45	0.42	0.53	0.50	0.59	0.65	0.68	0.55	0.55	0.55	0.75
QD (quartile deviation in mm)		0.71	0.64	0.70	0.79	0.78	0.69	0.66	0.74	0.77	0.73	0.75	0.69	0.71	0.66	0.64	0.62	0.68	0.69	0.68	0.59
Error in Sieving (%)		0.12	0.72	-0.02	-0.11	0.36	0.01	0.35	4.40	0.10	0.69	0.39	-0.99	0.15	-0.28	-0.09	-0.49	-0.44	-0.22	0.38	0.46

Appendix 14.

NE Alba Na Mara survey log, Marine Scotland, Marine Laboratory, Aberdeen

Author Mike Robertson (MSS)

Vessel FRV Alba na Mara

Cruise 1211A

Date 02 September – 13 September 2011

Ports

Loading	Fraserburgh, 29 August 2011
Port Call	Flexible, 7 September
Unloading	Fraserburgh, 13 September 2011

Personnel

M. Robertson	(SIC)
D. Bova	(2 – 7 September)
C. Shand	(2 – 7 September)
C. Hepple	(7 – 13 September)
L. Clark	(Visitor – SNH)
N. Hirst	(Visitor – Heriot Watt University)

Estimated days by project: 12 days – SP02q (10797)

Sampling Gear

- Day grabs, Bucket/Pipe dredge, grab table and sieving stand/s
- 1 mm sieves
- ROV plus cable
- Drop frame and TV sledge
- 600m umbilical

Objectives

1. To validate the presence and extent of the Horse Mussel *Modiolus modiolus* and map the full extent of the bed present in the area.
2. To determine the presence of other Primary Marine Features (PMFs) / Marine Protected Area (MPA) search features within the Noss Head survey area.
3. To determine the presence of PMFs and MPA search features within the “shelf deep” located within the Southern Trench.
4. To determine the presence of other PMFs / MPA search features within the Southern Trench survey area with a focus on the seabed located within the minke whale hotspot.

Narrative

Alba na Mara sailed from Fraserburgh at 1215 on Friday 2 September and, after completing safety and muster exercises, made passage to the northern sampling stations located off Noss Head. On arrival at 1900, a safe anchorage was identified in Sinclair Bay where the vessel spent the night.

At 0800 on the morning of 3 September, Alba moved to the first sampling position of 50 and commenced work on delineating the extent of Modiolus modiolus (Horse Mussel) beds in the area. A TV and digital still camera equipped sledge was deployed throughout the area of interest while grab samples were collected from specific sites (See Figure 1 and Table 1). Two ROV deployments were also attempted while in the Noss Head area, one while at anchor in Sinclair Bay and the other drifting with the tide. Work continued off Noss Head for the next few days and was concluded at 1500 hrs on the afternoon of 5 September with all objectives achieved. Alba then sailed for the Moray coast, arriving there and dropping anchor in Portsoy Bay at 2015 hrs.

On the morning of 6 September, the vessel sailed at 0800 for the Southern Trench and started a survey of the area. Over the next 5 days (7 – 11 September), video footage, digital still images and benthic grab samples were collected from a total of 74 stations throughout the Southern Trench (see Figure 2 and Table 2) with the vessel either dropping anchor in Aberdour Bay (2) or tying up in Fraserburgh Harbour (4) each night. All objectives were achieved. A gear and scientific staff change was carried out on the morning of 7 September in Fraserburgh. On the 12 September, because of the severe, southerly gale force winds forecast for the area, Alba remained in port.

After offloading the vessel, scientific personnel returned to Aberdeen on the morning of 13 September. Samples were transferred to a hire vehicle and driven to Edinburgh while all sampling equipment was also returned to Aberdeen.

Results

TV tows, digital still images and Day grab samples were collected from Noss Head and from the Southern Trench as detailed below. All sample and image analysis will be carried out by Heriot Watt University staff with a full report being available early next year.

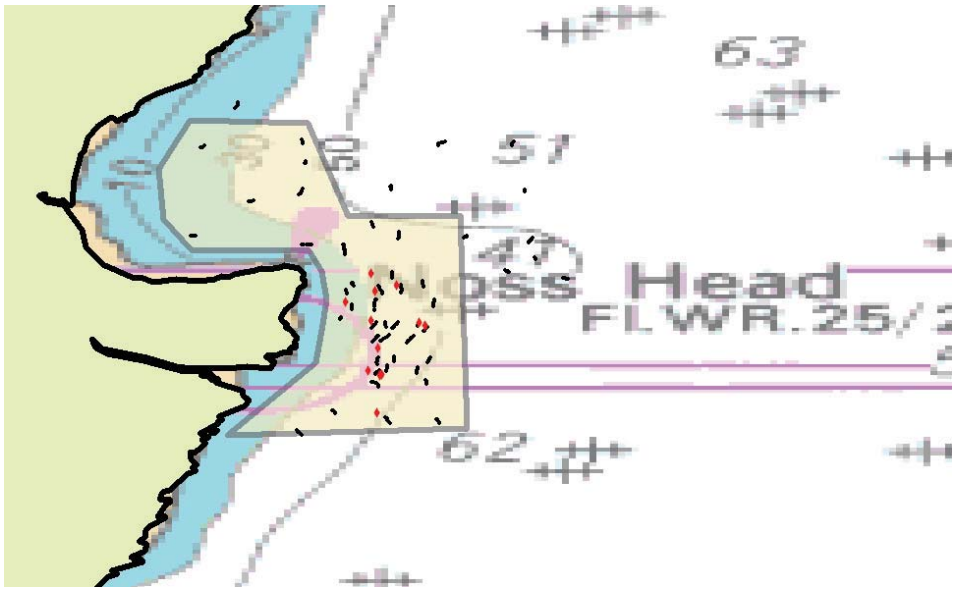


Figure 1. Noss Head Sampling Positions ♦ Grab Samples ● TV tows/digital stills

Date	TV Tows completed	Digital Still Photos	Valid Day Grab Samples
3/9/2011	26	200	0
4/9/2011	13	75	4
5/9/2011	12	61	3
Total	60	336	7

Table 1. Noss Head Sampling

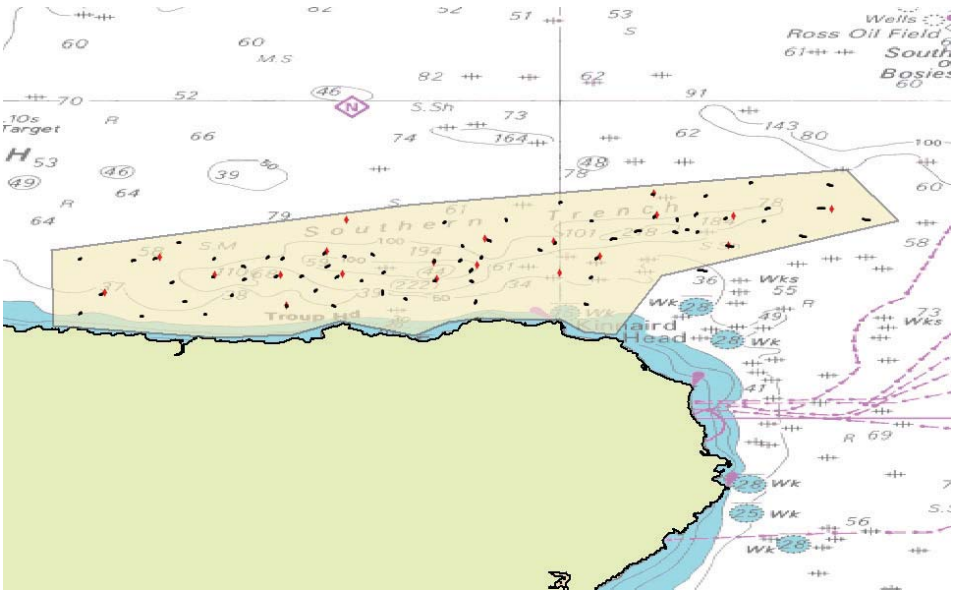


Figure 2. Southern Trench Sampling Positions. ♦ Grab Samples ● TV tows/digital stills

Date	TV Tows completed	Digital Still Photos	Valid Day Grab Samples	Comments
6/9/2011	15	149	3	
7/9/2011	5	51	1	Work abandoned - weather
8/9/2011	14	156	5	
9/9/2011	13	146	4	
10/9/2011	16	198	5	
11/9/2011	5	0	3	Digital still camera failed
Total	68	700	21	

Table 2. Southern Trench Sampling

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